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REPORT ON THE METROPOLITAN DISTRICT COMMISSION:

THE PARKS DIVISION AND CENTRAL MANAGEMENT SYSTEMS

September 12, 1983

Joseph R. Barresi
Inspector General

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SUMMARY

Introduction

The Metropolitan District Commission (MDC) is a State agency which delivers water services to 34 communities and sewer services to 43 communities within the greater Boston area, deploys a metropolitan police force, operates a wide range of recreational facilities serving 37 communities, and constructs and maintains bridges and roadways connecting MDC parks. During fiscal year 1982-1983, MDC operated with a budget of $71.7 million and a staff of approximately 2,500. The current MDC organization includes four operating divisions: Water, Sewer, Police, and Parks. The Parks Division is the largest, comprising 40 percent of MDC's total agency budget and 50 percent of MDC's staff.

In 1980 -- amid audit reports and media accounts of cost overruns and pervasive management deficiencies -- MDC hired a nationally-known management consulting firm, McKinsey & Company, Inc., to analyze MDC's organization and operations and to recommend improvements. The resulting five-volume report, issued in early 1981, recommended changes in MDC's organizational structure, personnel systems, project planning, project management, and maintenance operations. Subsequently, MDC signed a second contract with McKinsey for follow-up work to implement the recommendations produced by the initial study. The total cost of the McKinsey consulting contracts was nearly one-half million dollars.

Despite MDC's claims that it has corrected its management problems by implementing the McKinsey report's recommendations, the Office of Inspector General has received numerous complaints from citizens and public officials alleging wasteful mismanagement. This report tells the story, in several case studies of MDC projects, of what went wrong and why; analyzes the underlying causes of the problems evident in each case; evaluates the likelihood that such problems could recur today; and recommends ways to overcome these problems.

The Case Studies

Part I of the report contains four case studies of projects undertaken by the MDC Parks Division. The highlights of each case study are summarized below.

Chapter One
General Lawrence Bridge

Chapter One describes the design of a major new bridge to replace the existing General Lawrence Bridge over the Mystic River. It was estimated that a conventional steel girder replacement bridge would cost $2.6 million. However, because of the bridge's location in the Mystic River recreational area, MDC chose a more expensive, but arguably more attractive, concrete arch design. The bridge design was based on a magazine account of a bridge in Czechoslovakia whose reinforced concrete arch spans were among the longest in the world. There was no other bridge of similar design in the United States. Moreover, the Czech design required a 138-foot clearance above the water, whereas the required clearance above the water at the relatively flat Medford site was only 16 and one-half feet. One early estimate placed the cost of constructing a concrete arch bridge at nearly $7 million. Somerville Engineering, Inc. was hired to design the bridge at a cost of $460,000, and design work began in 1975. It was estimated that the design would take about 18 months to complete.

Seven years later, in 1982, the design work for the bridge was still not complete. As a result of inflation, design problems, and the time delay, the cost of the Somerville contract had risen to $833,000, and it appeared that the final design cost might reach $1 million by the end of the project. Three million dollars in construction funds had also been spent on site preparation work made necessary largely by the unusual design of the bridge. The total cost of the bridge project was now estimated at $15 million.

The problems encountered on the General Lawrence Bridge project, and the concomitant waste of nearly $4 million in public funds to date, resulted in large part from MDC's inability to properly manage the engineering design process and from Somerville Engineering's negligence. The MDC project engineer responsible for

overseeing the consultant's work has stated that the General Lawrence Bridge design was beyond his expertise. As a consequence of MDC's lack of technical expertise, MDC failed to foresee and prevent major technical problems with the bridge design: MDC failed to recognize that the early design required a 22 percent highway grade -- seven percent is considered extremely steep for highways -- and that the bridge's heavy approach embankments could cause dangerous soil settlement problems. These design problems, which were not discovered for several years, ultimately led to the development of an entirely new structural design, the expenditure of an additional $200,000 for soil studies, and project delays of 18 to 24 months.

More serious errors in the consultant's designs of the bridge superstructure and foundation were never discovered by MDC: two of the errors would have caused the bridge to collapse, and two others would have caused the roadway leading to the bridge to buckle, crack, and eventually collapse. Had the consultant not experienced a fortuitous change of staff, these errors could have gone undetected, with disastrous consequences.

Throughout the project, MDC's management controls were inadequate. MDC selected Somerville Engineering to design the bridge without reviewing the firm's qualifications; in fact, none of Somerville Engineering's key staff had designed a working bridge of the size and complexity of the proposed bridge, and Somerville Engineering's proposal misrepresented the person who would supervise the project. MDC incurred unnecessary costs by approving excessive contract overhead rates based on unaudited false claims. MDC spent considerable time reviewing design work already out of date and approved invoices for work that MDC did not know was being undertaken. Three field personnel were assigned to monitor the project when very little field work was taking place, resulting in approximately $100,000 in unnecessary labor costs. Even when MDC decided not to continue with the concrete arch design in August 1982 (after the Inspector General's Office advised MDC to reevaluate the project), MDC failed to cancel the original design contract. As of this writing, work on a new design has not yet begun.

Chapter Two
Tenean Beach

Chapter Two evaluates the upgrading of a beach recreation facility at Tenean Beach. In 1978, the MDC Commission approved a rehabilitation project for Tenean Beach. The rehabilitation was estimated to cost $300,000. Five years later, in 1983, the project has not yet been finished. The construction contractor walked off the job in 1981 and filed suit against the Commonwealth, alleging deficiencies in the design and management of the project. A new contractor has been hired, and the total estimated cost of the project has now risen to nearly $900,000.

Throughout most of the 1970's, during which the MDC Commission was considering proposals to redevelop Tenean Beach, the beach was unfit for swimming. Despite the fact that MDC was forced to close the beach in response to high pollution levels for most of the summer of 1969, and again in 1972, MDC never studied alternatives to redeveloping the beach, such as construction of a public swimming pool at the beach to be used when the ocean pollution levels were excessive.

MDC then awarded the Tenean Beach design contract to a firm which was responsible for substantial construction problems on another State project, and whose proposal failed to address the site's flooding problems. Not surprisingly, the consultant's design also failed to account for flooding problems; consequently, a large area of the park will be subject to periodic flooding by corrosive salt water.

The project design also included a granite wall whose purpose and function have never been clear. MDC's project engineer believes that the wall is designed to serve as a barrier to prevent flooding of the parking lot, despite the fact that there are openings in the wall for pedestrian access every 20 feet or so. The consultant, however, denies that the wall will prevent flooding and maintains that the wall will simply provide seating for park users. The consultant estimated that construction of the wall would cost MDC $40,000; however, the contractor -- who initially submitted a $10,000 bid to construct the wall -- subsequently demanded an additional $95,000 to complete it.

As of this writing, the construction work has not been completed.

Chapter Three
Three Charles River Bridges

Chapter Three reviews the design of repairs to three adjacent spans over the Charles River: the Larz Anderson, Western Avenue, and River Street Bridges. In 1978, MDC initiated procedures to procure design services, and in 1979 a consultant contract for $146,000 was awarded to Somerville Engineering, the firm which was also designing the replacement of the General Lawrence Bridge for MDC.

The repairs on two of the bridges were not completed until four and one-half years after the project began; MDC was forced to stop work altogether on the River Street Bridge. Costs incurred to date on the Three Charles River Bridges project have exceeded $725,000 for design and construction, compared with $550,000 originally budgeted. Final costs will be much higher, because new contracts for reinspection, design, and repair of the River Street Bridge have not yet been let.

The cost overruns were largely attributable to MDC's failure to ensure adequate inspections of the three bridges. Because MDC did not require the consultant to conduct "hands-on" inspections, the consultant only visually inspected the bridges, except in easily accessible places at the shoreline. Consequently, the consultant dramatically underestimated the extent to which all three bridges had deteriorated: in fact, concrete cracking was four times as extensive as the consultant reported; and patches of concrete deterioration were at least twice as extensive.

Chapter Four
George's Island Pipeline

Chapter Four reports on an effort to repair a damaged water pipeline between the town of Hull and George's Island. The project involved inserting a new four-inch plastic pipe through the old ten-inch cast-iron pipe, a method referred to as sliplining. MDC thought the project would be simple: the project cost was estimated at $65,000, and the project schedule was one month. These estimates proved unduly optimistic; in fact, project costs exceeded $300,000, and the

waterline repairs were not completed until June 1983 -- 17 months after the project began.

MDC's mismanagement of the project led to a series of project cost overruns and schedule delays. On December 1, 1981, MDC signed a contract requiring the contractor to begin work on December 14, 1981 and stated that an extension of time would only be granted under extraordinary circumstances; one week later, on December 21, 1981, MDC granted a five-month extension, citing "inclement weather" and "extreme cold" as extraordinary circumstances during a New England winter. MDC further authorized the project contractor to use work methods to clean the pipeline which caused the pipeline to become blocked. In attempting to clear these blockages, MDC authorized the contractor to use work methods which caused further blockages.

Throughout the project, MDC staff repeatedly circumvented MDC's contract procedures in authorizing payments to the contractor: MDC paid the contractor for work that had not been done, for undocumented work, and for work done without a contract. These unjustified payments alone totalled close to $75,000. On one occasion MDC staff significantly understated to the Commission the amount of extra work the contractor had already performed. To date, the pipeline repair project has cost more than four times MDC's initial estimate, and is likely to exceed MDC's current appropriation by at least $66,000.

MDC Management Systems

Part II of the report focuses directly on the current functioning of MDC's basic management systems, particularly the systems McKinsey addressed in its study. This review considers the policies, procedures, organizational units, and results associated with the management systems in both the Parks Division and MDC's central administration. Six management systems are reviewed; the findings are summarized below.

Chapter Five
Project Planning

The McKinsey report recommended that strong planning functions be institutionalized at the division level, that MDC's central Planning Office be responsible for overseeing the divisions' planning activities, and that MDC adopt a formal planning process. However, despite the claims of recent MDC Commissioners Geoghegan and Nylen to the effect that the McKinsey planning system was fully implemented and working well, the Inspector General's review of the process by which the Parks Division today plans programs and selects projects reveals that the planning system designed for MDC by McKinsey has been implemented only in appearance. MDC's two master plans for the Parks Division were prepared in 1956 and 1968, respectively; neither has been updated in accordance with McKinsey's recommended procedures. In addition, Parks Division officials state that the existing master plans have no effect on the division's planning and project selection activities.

Moreover, the MDC Commission does not guide the resource allocation process within the Parks Division. Instead, the Division Director makes all final project selection decisions, which are routinely approved by the Commission. Project alternatives are not seriously analyzed or considered by either division staff or the Commission.

In addition, Parks Division engineers are not expected to prepare accurate project cost estimates, nor do they evaluate the reliability of project cost estimates prepared by consultants and contractors. By failing to ensure that project cost estimates are reliable, the Parks Division increases the risk that feasible project alternatives will not be examined, and that funds may therefore be appropriated to design projects and construction contracts whose costs are unnecessarily high.

Chapter Six
Consultant Screening and Selection

All major construction projects undertaken by MDC's Parks Division are designed by private firms under contract to the Commission. The consultant's design fee can range up to ten percent of the project construction cost; thus, the

negative impact of a poor consultant selection decision on public expenditures far exceeds the cost of the design contract.

MDC officials have stated that the consultant selection process outlined in the McKinsey project management manual is currently followed in selecting consultants for MDC projects. However, the Inspector General's review of current consultant selection practices indicates that MDC has discarded many of the procedures prescribed by the McKinsey manual, and has in other respects failed to achieve the safeguards that an adequate consultant selection procedure would provide. For example: although the McKinsey manual specifies seven screening criteria -- including project experience, key personnel, and resources of the firm -- the Contract Administrator and Consultant Selection Committee members interviewed reported that they base their consultant screening decisions on several unwritten criteria developed by the Committee. These criteria include the firm's age, location, and the amount of other current MDC work. According to the Contract Administrator, a firm which has operated for fewer than five years is not selected by the Committee, since MDC prefers to contract with "tried and true" firms. One Committee member stated that if the Committee receives a larger number of letters of interest from firms based in Massachusetts, he eliminates firms located outside Massachusetts from further consideration. All Committee members interviewed stated that the Committee has the responsibility to "spread the work around" by distributing design contracts evenly among the consulting firms regarded by the Committee as qualified.

In addition, the Committee lacks complete information regarding consultants' past performance on MDC projects. To the extent that Committee members consider past performance in their screening decisions, they rely on division employees' undocumented recollections. This anecdotal method furnishes no assurance that past problems experienced with consultants will be consistently identified, accurately diagnosed, reported to the Committee, and used to screen out unsuitable applicants.

The Committee's procedures for evaluating the proposals MDC receives from the screened consulting firms are equally idiosyncratic. Committee members are not required by the Contract Administrator to use standard evaluation categories, weights, or forms; instead they are free to invent their own proposal selection criteria and methods, which frequently deviate from the Commission's approved consultant selection process. Moreover, completed evaluation forms are not

retained for future use. One Committee member defended the Committee's failure to document the evaluation process by stating, "Why open it up to criticism?"

Finally, procedural changes adopted by the Consultant Selection Committee or its members have in effect caused major policy shifts which have never been voted on or approved by the MDC Commission. For example, one Committee member acknowledged that while he knew it was MDC policy to assign a weight of 20 percent to equal employment opportunity compliance, he did not believe that MDC should be running a social program, and therefore assigned this category a weight of only five percent.

Chapter Seven
Contractor Prequalification and Selection

Massachusetts General Laws Chapter 29, section 8B requires that contractors who wish to bid on MDC-administered construction contracts totalling $50,000 or more first be prequalified. To become prequalified to bid, a contractor must submit a prequalification statement which includes detailed information regarding the firm's experience, financial condition, and staff capability, to MDC's Prequalification Office. MDC's Prequalification Committee decides by majority vote the dollar amount and categories of work each contractor will be prequalified to perform for MDC.

The Inspector General's review of MDC's current prequalification process revealed that MDC prequalifies and accepts bids from contractors who have performed unsatisfactorily in the past. A firm with a history of poor project management and deficient work is likely to be prequalified by the Committee if the firm's financial capability is deemed adequate by the MDC consultant responsible for reviewing the firm's financial statement. After the bids on a contract have been opened and an apparent low bidder has been identified, the project engineer is responsible for checking the bid and for reviewing the contractor's past performance; however, MDC does not reject bids upon learning of a contractor's unsatisfactory past performance. The Contract Administrator has stated, "I don't believe you can deny a contractor a job just because he didn't manage a contract well." Although MDC has on occasion revoked or threatened to revoke a contractor's prequalification in response to poor progress or performance on an

ongoing MDC project, MDC has never sought to debar a contractor, according to the Contract Administrator. MDC's failure to deny prequalification status, reject bids, or seek debarment of contractors in response to poor contractor performance increases the likelihood that these same contractors will contribute to future project delays, cost overruns, and other problems.

Chapter Eight
Project Management

The Inspector General's review of MDC's actual current project management procedures demonstrates that MDC has adopted only the appearance, not the substance, of McKinsey's project management recommendations. Project engineers are not required to report to division management or to the Contract Administrator on the status of contract work at scheduled milestones. Similary, project engineers are not required to verify that the work billed on invoices received by the MDC has in fact been performed; rather, invoices are approved and paid if they appear consistent with contract requirements and their arithmetic is correct. In fact, the Parks Division Director has stated that he has never refused to pay a consultant's invoice. Moreover, neither division management nor the Contract Administrator attempts to anticipate or prevent project cost overruns or delays, and project engineers are not required to document problems and significant events after their assigned projects have been completed.

In short -- the McKinsey manual's prescriptions notwithstanding -- the Parks Division's project management procedures entrust to the consultants who contract with MDC virtually all responsibility for overseeing and controlling their own work. The Parks Division's reliance on consultants to police themselves, which seems questionable in any case, is made to appear even more misguided by MDC's policy of choosing consultants with little consideration of their past performance.

The Parks Division's capability to manage MDC projects is further reduced by uneven workload assignments to project engineers. Division officials state that it is often necessary to assign "unqualified" staff to the project engineer role because of the low number of qualified engineering staff relative to the division's project workload. To minimize the potential risks associated with assigning project management responsibilities to unqualified or underqualified staff, the Parks Division assigns a disproportionate share of such responsibilities to those engineers perceived

by management to be the most competent. By thus overextending its most capable engineers, the Parks Division saps their effectiveness.

Chapter Nine
Maintenance

The 1981 McKinsey report characterized maintenance of MDC facilities as a "vicious cycle" of inadequate preventive maintenance, poor equipment, and insufficient resources. Yet, two years after the McKinsey study completion, the division continues to lack a coherent, comprehensive maintenance program to protect and preserve the MDC parks and recreation system -- a resource estimated by the Senate Ways and Means Committee to represent a public investment of $1 billion.

The Parks Division has not undertaken a comprehensive assessment of the division's preventive and remedial maintenance requirements. Because the Parks Division does not systematically identify its maintenance needs, it is unable to estimate the total resources required to address these needs. Moreover, actual maintenance expenditures are not tracked. Maintenance staff, supplies, and equipment are not budgeted in a single line-item or account, and division staff are therefore unable to pinpoint current expenditure levels for preventive and remedial maintenance.

The Parks Division's failure to systematically identify and plan for the maintenance needs of MDC's parks and recreation system invites wastefully high repair costs and public safety hazards, as illustrated by the history of the Harvard Bridge (also called the "Mass. Ave. Bridge"), which MDC is responsible for inspecting and maintaining. In 1972, MDC hired a structural consultant, Dr. Kenneth Leet, to evaluate the condition of the Harvard Bridge. The consultant told MDC that the bridge's expansion joints required "considerable maintenance"; outlined a series of required repairs; advised MDC to prevent trucks weighing over 15 tons from using the bridge; and recommended that MDC replace the bridge superstructure (excluding the foundation), on the grounds that the bridge's strength was 30 to 50 percent below that required for the loads it carried. The consultant estimated the cost of the new superstructure at $3 million. Moreover, the consultant's report to MDC emphasized that the firm MDC had hired to measure and inspect the bridge, Hub Testing, had not furnished adequate or complete inspection

data; consequently, the consultant noted, the report's analysis was based on the optimistic assumption that no portions of the bridge structure were loose or deteriorated.

MDC did not undertake the maintenance and repair work which the 1972 consultant report had cited as necessary during the period between 1972 and 1983. MDC did post signs for a 15-ton limit; however, the signs were located at the bridge entrance, where overweight trucks are unable to turn around and exit before crossing the bridge. Finally, in June 1983 -- one week after a bridge collapse in Connecticut drew national media coverage -- MDC closed the two outside lanes of the Harvard Bridge, reporting that cracks had been discovered in the metal hangers connecting the pins at the bridge's expansion joints -- precisely the location cited as high risk by the 1972 consultant report. Replacement of the bridge superstructure will take at least four years, and will cost well over $12 million.

In addition to creating public safety hazards, the Parks Division's continued failure to develop an effective maintenance program could cause MDC to lose more than an estimated $20 million in Federal aid for the reconstruction of the Harvard Bridge and two Alewife Brook Parkway bridges. The Federal Highway Administration (FHWA), which distributes aid for bridge reconstruction, requires recipients of FHWA funds to meet established FHWA standards for bridge maintenance and inspection. In November 1980, FHWA requested documentation of MDC's bridge maintenance program. As of July 1983, MDC had not furnished FHWA with the proper documentation.

According to several district superintendents, the Parks Division's maintenance forces are too few in number and lack the necessary training and experience to carry out their duties. One district superintendent stated that the Parks Division places heavy reliance on unskilled seasonal workers to maintain the division's bridges and roads. Another district superintendent stated that his maintenance force is qualified only to mow lawns and pick up litter. District maintenance forces also lack adequate landscaping training and experience, according to division landscape architects; they stated that ten to fifteen percent of the trees throughout MDC's parks system may be dying from neglect and mistreatment stemming from the inexperience and carelessness of district crews.

Chapter Ten
Personnel Management

The delays, cost overruns, and design and construction deficiencies evident in the case studies of Parks Division projects seem to have stemmed in large measure from problems associated with the division's engineering personnel. The Inspector General's review of personnel management at MDC revealed that the Parks Division lacks the qualified staff required to manage MDC's design and construction projects. According to the Parks Division Director, the 24 engineers assigned to manage the division's projects are unable to understand or review the engineering calculations prepared by MDC's design consultants for the major structural projects the division routinely undertakes. The potential consequences of the division's inability to review structural calculations are sobering. At least half of the Parks Division's approximately 40 current major projects involve building or rehabilitating buildings, bridges, rinks, piers, and dams; for these projects, MDC hires consultants to prepare the structural plans, specifications, and calculations. For approximately 20 major projects, then, MDC lacks the expertise required to verify the consultants' work. Thus, if a consultant submitted structural plans containing serious errors in calculating the strength of wind, tidal, or other forces -- any of which could ultimately cause a bridge or building to crack or collapse, MDC's project engineer would be incapable of discovering these calculation errors.

By statute, any person who practices engineering -- defined as any professional service requiring engineering, training, and experience, including "investigation, evaluation, planning, design and supervision of construction for the purpose of assuring compliance with specifications..." -- must be registered as a Professional Engineer by the State Board of Registration. The statute does permit unregistered persons to perform engineering work, provided that "such work does not include final designs or decisions and is done under the direct responsibility, checking and supervision of a person holding a certificate of registration...."[1] MDC's personnel records show that only six of the 24 project engineers responsible for managing and monitoring the Parks Division's design and construction projects are registered Professional Engineers. (One is a registered Landscape Architect.)

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[1] Massachusetts General Laws Chapter 112, section 81D.

Fourteen have college or advanced degrees in engineering disciplines; seven have neither a Professional Engineer license nor an engineering degree. Of the 73 Parks Division employees with engineering titles, only one-eighth (nine) are Registered Engineers, and only one-third (24) have college or advanced degrees in engineering disciplines. Over half (42) of these employees with engineering titles have neither a Professional Engineer license nor an engineering degree.

Despite the acknowledged need for highly qualified staff, the Parks Division has not recruited experienced staff in recent years. Rather, the division staffs almost all senior-level engineering positions by internal promotion, thereby missing opportunities to upgrade the division's engineering and administrative capacity. Most of these senior positions are occupied by individuals who have neither passed a qualifying examination nor received civil service certification in their current positions.

Finally, despite MDC's substantial investment of funds and staff in consultant contracts (including the McKinsey study) to design and implement personnel systems for MDC, MDC has failed to implement any of the recommended systems. Although MDC commissioned the design of two separate performance appraisal systems in 1980 and 1981, MDC has not conducted formal employee performance appraisals since late 1980. Although MDC has been advised to institute in-house training programs by several in-house and external sources over the past decade, MDC does not plan or budget for staff training. According to the Parks Division Director, all training furnished to engineers is on-the-job training.

Conclusions

The case studies and management system reviews summarized in this report raise serious doubts concerning MDC's capacity to carry out its legislated responsibilities effectively and economically. The findings of this report clearly

suggest three disturbing conclusions about MDC generally and the Parks Division[2] specifically:

1. MDC's Parks Division is incapable of maintaining its past capital investments.

2. MDC is incapable of managing its present design and construction work.

3. MDC is incapable of controlling its future direction.

This report reviews four MDC projects which had experienced cost overruns. When these cases were selected for review, it was not known that the case studies would also reveal serious engineering defects, lack of management controls, and billing irregularities. Yet the studies uncovered one instance in which MDC approved the design of a bridge destined to collapse, and another in which MDC built a $100,000 wall which the project engineer incorrectly believed would serve as a breakwater but which in fact will serve only as a bench. The studies further revealed incidents of unjustified billings and payment of invoices for work which MDC did not even know was being done.

In hindsight, it is not surprising that such deficiencies were discovered. This report reveals that MDC's Parks Division engineers are unqualified to supervise many of the agency's projects, that cost controls are virtually nonexistent, and that policies and procedures needed for effective project management are sorely lacking. Thus, there is a compelling need for MDC to review immediately its other current projects for safety and waste, and to halt its expansion into new activities until it can address these problems.

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[2] Because our report focused on MDC's Parks Division, one cannot be certain that the widespread deficiencies clearly evident in that division are present to the same extent in the Water Division, the Sewer Division, the Police Division, and the Commission's other operating units. However, in the course of reviewing the Parks Division's activities and procedures, this report has also reviewed, and found pervasive shortcomings in, some of MDC's most important central management systems -- personnel administration, long-range planning and budgeting, consultant selection, and contract administration. It seems reasonable to conclude that problems in these central systems have caused related problems throughout all of MDC's operating divisions. Conclusive documentation of any such problems in the Sewer, Water, and Police Divisions would require extensive studies of those units.

The needed changes recommended by this report are so basic and pervasive that they will surely take considerable effort and time to complete. They are also interrelated, so that a massive, coordinated effort is required; piecemeal efforts will not suffice. Action and support will be needed not only from MDC itself but also from other officials and agencies in the executive branch, from the Legislature, and from the communities which comprise the metropolitan districts. It can be stated with certainty that without these extensive reforms, MDC will not be able to effectively carry out its public mission.

The problems MDC faces will not be remedied (as MDC's half million-dollar engagement with McKinsey clearly has shown) by contracting for yet another management consultant study while the agency continues to carry out projects that its personnel are neither qualified to execute nor equipped to maintain. Enough time and resources have been devoted to pointing out MDC's long-standing deficiencies. MDC and the Administration now face the challenge of bringing the agency back under control.

Implementation Strategies And Priorities

The Inspector General recommends that MDC implement this report's recommendations for change (outlined in Chapters Five through Ten) in accordance with the following strategies and priorities:

1. MDC should immediately establish a three-part organizational spearhead for change. First, the Governor should establish a Task Force on Professional Performance to define the concrete responsibilities and required qualifications of all key engineering and administrative positions within MDC's central staff and Parks Division.

   Second, the Governor should appoint a Management Assistance Team, comprised of private and public sector volunteers who have demonstrated significant accomplishments in the fields of organizational management, engineering, and

engineering administration, to provide immediate technical support to MDC's current engineers and administrators.

Third, the MDC Commissioner should establish a permanent Independent Audit Unit to monitor and report on the extent to which MDC's high risk projects are planned and executed efficiently, effectively, and in compliance with the Commission's policies and State statutes.

2. MDC should immediately review all significant current Parks Division projects.

3. MDC should immediately begin upgrading the qualifications of its key professional personnel.

4. MDC should immediately establish, issue, and enforce written policies to guide Parks Division activities and projects.

5. MDC should immediately develop and begin to execute an effective plan for implementing this report's recommendations.

6. MDC's annual project workload should be reduced as required to ensure that all MDC managers have the time necessary to participate intensively in implementing all of this report's recommendations.

7. The Legislature should allow MDC sufficient time and funds to implement this report's recommendations.

INTRODUCTION

Background

The Metropolitan District Commission

The Metropolitan District Commission (MDC), a State agency under the jurisdiction of the Executive Office of Environmental Affairs, was created in 1919 when the State Legislature consolidated separate metropolitan water, sewer, and parks commissions to facilitate efficient service delivery. MDC currently delivers water services to 34 communities and sewer services to 43 communities within the greater Boston area, deploys a metropolitan police force, operates a wide range of recreational facilities serving 37 communities, and constructs and maintains bridges and roadways connecting MDC parks. During fiscal year 1982-1983, MDC operated with a budget of $71.7 million and a staff of approximately 2,500. In addition, as one of the largest public construction agencies in the State, MDC expends millions of dollars on construction and repair of buildings, roadways, bridges, and other facilities; these capital outlay projects are financed by bond issues.

MDC is headed by a full-time Commissioner, who serves as the agency's chief executive and operating officer. There are also four part-time Associate Commissioners who, along with the Commissioner, comprise the MDC Commission. Contract approvals and other official Commission actions require the consent of the Commissioner plus at least two of the four Associate Commissioners. The Commissioner and the Associate Commissioners are appointed by and serve coterminously with the Governor. Since early in 1979, five individuals have served as full-time Commissioner.

The Parks Division

The current MDC organization includes four operating divisions: Water, Sewer, Police, and Parks. The Parks Division is the largest, comprising 40 percent of MDC's total agency budget and 50 percent of MDC's staff.

MDC's parks and recreation network covers approximately 15,000 acres of reservations and open space, and 17 miles of coastal land; the network includes salt water beaches, skating rinks, tennis courts, swimming pools, stadiums, zoos, golf courses, playgrounds, a downhill ski area, over 100 vehicular bridges, and a variety of other facilities, roadways, and structures within the Metropolitan Parks District. Over the past decade, MDC's parks program has experienced significant reductions in personnel and facility funding.[1] The number of permanent Parks Division employees has declined by 30 percent, the number of seasonal employees by 23 percent. These declines resulted from attrition (on average, one Parks Division employee reaches retirement age every month), as well as from a State-wide hiring freeze instituted in 1980, which has prevented MDC from hiring new employees to fill vacant positions at all levels within the agency. Funding for the parks program, which is derived from assessments on the 37 cities and towns within the Metropolitan Parks District and from user fees, has also decreased in recent years; in fiscal years 1982 and 1983, the Legislature authorized no capital outlay funds at all for MDC facilities. MDC has therefore relied on proceeds from prior bond sales to finance ongoing capital projects.

MDC's parks and recreation network has continued to expand despite staff and funding cutbacks. Between 1970 and 1983, the parks program acquired 1,000 additional acres of land, constructed a variety of new recreational facilities, and was assigned responsibility for facilities at several park sites. MDC has historically relied on consultants and contractors to design and construct parks projects, to conduct feasibility studies, to maintain parks facilities and equipment, and to perform other critical agency functions. Yet, despite the substantial allocation of work to consultants, the Parks Division's staff capability has been inadequate to the task of managing the current volume of project work. Consequently, project delays, cost overruns, and design and construction problems have been frequent. These difficulties have been widely reported in the press and repeatedly noted in the State Auditor's reports.

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[1] See Feasibility Analysis of Merging DEM and MDC Parks Programs (Boston: Office of Policy and Management Analysis, Executive Office of Environmental Affairs, January 1983), p. 15.

The McKinsey Report

In 1980 -- amid audit reports and media accounts of pervasive management deficiencies -- MDC hired a nationally-known management consulting firm, McKinsey & Company, Inc., to analyze MDC's organization and operations and to recommend improvements. The resulting five-volume report, issued in early 1981, recommended changes in MDC's organizational structure, personnel systems, project planning, project management, and maintenance operations. The cost of this initial study was $322,135. Subsequently, MDC signed a second contract with McKinsey for follow-up work to implement the recommendations produced by the initial study; the implementation study, which cost MDC an additional $168,385, yielded two detailed procedural manuals: a project planning system manual and a project management system manual. The MDC Commission formally adopted McKinsey's two implementation manuals in July 1981.[2]

In conjunction with its recommendations for changing MDC's management systems, the McKinsey report recommended changes in the agency's organizational structure. McKinsey's recommended changes to organizational structure, shown in Figure A, are summarized below.

Consolidate reporting lines - McKinsey recommended creating an Administrative Services Division, whose director would supervise many of the staff groups which previously had reported directly to the Commissioner. Groups to be included in this new division were public relations, general counsel, contract administration, finance, data processing, and personnel. The personnel group itself would be a consolidation of the previously existing personnel, labor relations, and affirmative action groups. (See Figure B.)

This recommendation was not adopted. Consequently, the Commissioner today has 16 people reporting directly to him. (See Figure C.)

Eliminate the Chief Engineer - McKinsey recommended eliminating the position of Chief Engineer, arguing that doing so would remove an unnecessary level of bureaucracy and would help focus accountability on the division directors.

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[2] MDC Commission records indicate that the Commission adopted the Planning System Manual, but fail to cite the Project Management System Manual. Nevertheless, the Contract Administrator has stated that the Commission voted to adopt both manuals in 1981.

Figure A

Metropolitan District Commission
Pre-1981 Organization

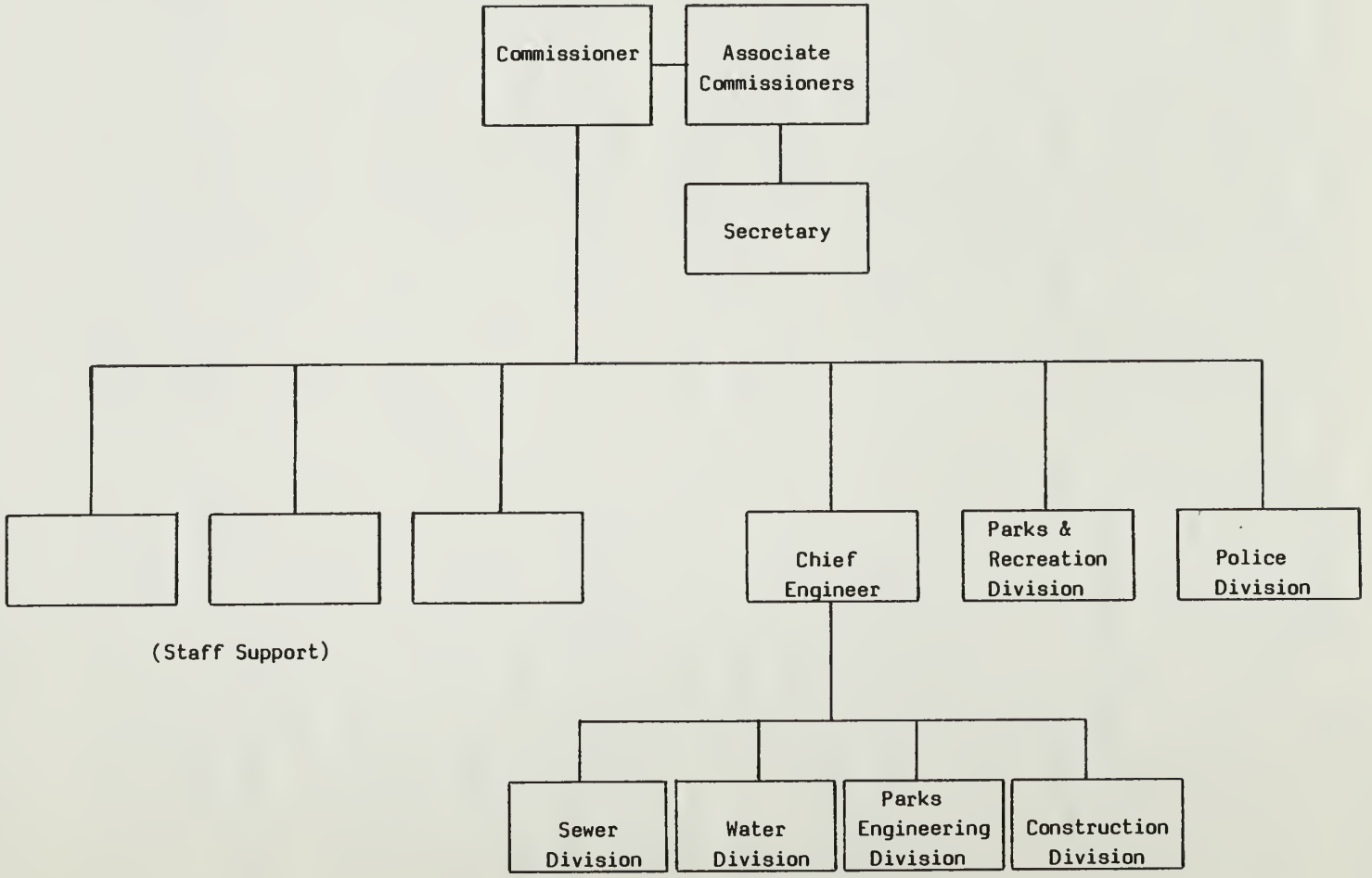


Figure B

Metropolitan District Commission
McKinsey Proposals

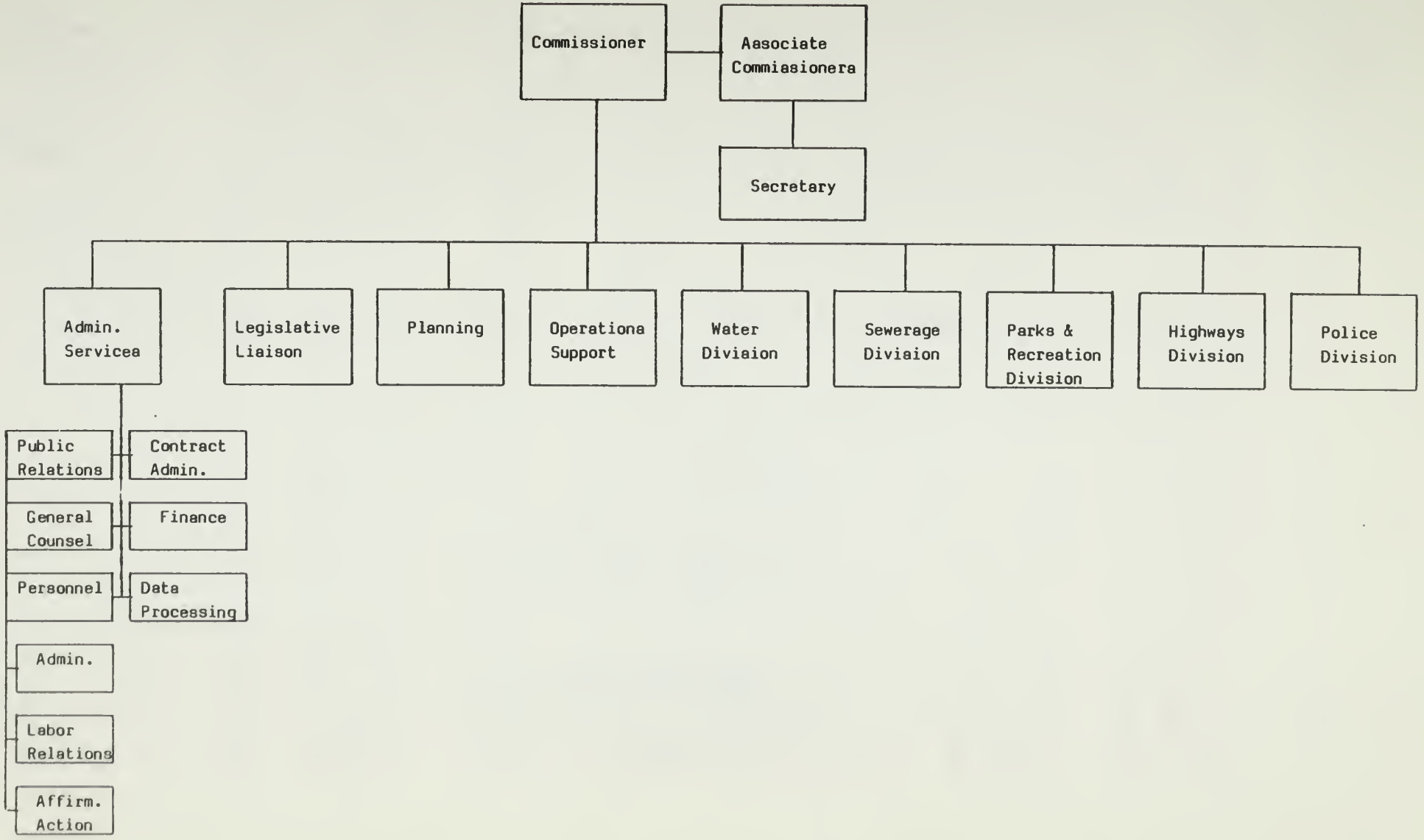
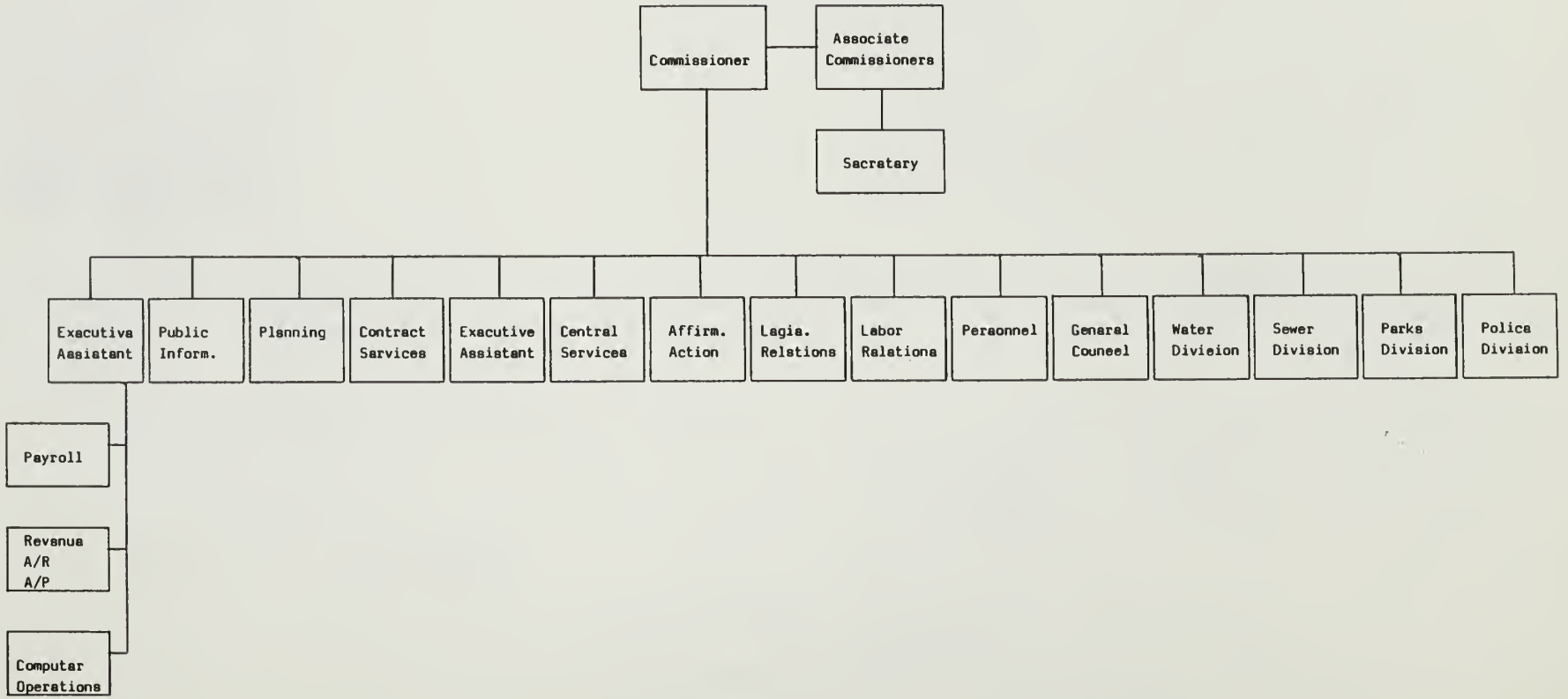


Figure C

Metropolitan District Commission
Current Organization



The recommendation was implemented, and the position was eliminated in 1981.

Eliminate the Construction and Parks Engineering Divisions - These two recommendations were also aimed at focusing accountability on the division directors. Parks Engineering would be combined with Parks and Recreation to create a single Parks Division. The Construction Division would be eliminated and its personnel reassigned to the other divisions.

Both of these recommendations were implemented. Technically the Construction Division was not eliminated; because it was established by statute, only an act of the Legislature can formally abolish it. However, all of its employees were administratively assigned to the other divisions. These employees have retained their temporary, non-civil service designations.

Create project planning and management groups - McKinsey recommended the creation of a project planning and management group within each of the major operating divisions. These groups would have responsibility for supervising the design and construction of new facilities and improvements, as well as contracted repairs and maintenance. It was further recommended that a set of program areas be defined for each division, with an engineer designated as program manager for each program to provide coordination, supervision, and expertise at the staff level.

Project planning and management groups have been established in the three divisions. The Parks Division has identified ten programs and assigned a program manager to each.

Create a central planning office - McKinsey recommended the establishment of a central planning office to coordinate and monitor the planning activities of the line divisions.

This office was established.

Appoint a Contract Administrator - McKinsey recommended creating a new position of Contract Administrator. The Contract Administrator would handle the business and financial aspects of contracts, thus freeing project engineers to work on technical supervision.

In response to this recommendation, MDC appointed a Contract Administrator in 1981.

Appoint an engineering advisor - Finally, McKinsey recommended creating an engineering advisor position, to be located in one of the central support groups. This position would provide technical quality control capabilities.

The recommendation was not implemented.

MDC has frequently used the McKinsey contracts to defend itself against criticisms of the agency's current performance. In July 1981, amid charges by State representatives of "serious allegations of corruption and maladministration within the Metropolitan District Commission...," MDC Commissioner Geoghegan dismissed such allegations as baseless and offered the McKinsey report as proof of MDC's capacity to manage itself effectively:

> "When I became Commissioner, it became clear to me that a total evaluation of how the MDC operates would be necessary to make it more efficient. In order to accomplish this, with the cooperation of the Secretary of Environmental Affairs, we brought in a management consultant firm to study the agency and make recommendations for its improvement and revitalization. This was done working through task forces composed of MDC employees. The result was a series of five reports with specific recommendations. Unlike most studies done by the State, this one has been implemented....All procedures and methods are fully documented to provide professional evaluation with full back-up for evaluation by the Commission before final award."

In the fall of 1981, MDC Commissioner Geoghegan, in an appearance before the Governor's Council, used the McKinsey report in countering criticisms of MDC contained in a report by the State Auditor. The Commissioner's testimony reported that upon his appointment in May 1980, he had "brought in a major management consultant team [McKinsey & Company, Inc.] to do a reorganization of the MDC in order to correct the long-standing problems."

The Commissioner assured the Governor's Council that:

> "The management team made its recommendations and these have been implemented. The results have been that we now have a single line of responsibility and authority in each operating division and we have all of the projects in each division of Sewer/Water/Parks on a schedule of accomplishment running for the next two years. All of these projects are reviewed on a monthly basis for conformance to time and dollar schedules. This review is done by an independent group of contract administration [sic] and Exception Reports are brought directly to the Commission. In this way, we expect to avoid the problems of cost overruns and time overruns which have occurred in the past."

Study Design And Report Format

Despite MDC's claims that it has corrected its management problems by implementing the McKinsey report's recommendations, the Office of Inspector General has received numerous complaints from citizens and public officials alleging wasteful mismanagement in the Commission's projects. Allegations concerning waste and mismanagement have been reviewed by the Office's Engineering and Management Divisions. In reviewing several cases of apparent waste and mismanagement, it appeared that, although the cases differed from one another in important respects, they nonetheless exhibited common underlying deficiencies in management controls and systems. It was therefore decided to prepare a single report which would:

1. tell the story, in several case studies of MDC projects, of what went wrong and why;
2. analyze the underlying causes of the problems evident in each case;
3. evaluate the likelihood that such problems could recur today; and
4. recommend ways to overcome these underlying causes of waste and mismanagement by making needed improvements in the agency's basic management systems.

The case studies

Part I of the report contains four case studies of projects undertaken by the MDC Parks Division. In each case, the Inspector General's Engineering and Management Division staffs reviewed background materials, analyzed project documents, interviewed MDC officials and consultants, and made on-site field observations. Each study describes what should have happened, and what actually did happen, with respect to key aspects of project administration including: project planning and needs assessment, project staffing, consultant selection, contractor prequalification, project management, and project evaluation.

The four cases do not necessarily portray every significant activity undertaken by the Parks Division, although together they do illustrate a broad range of its activities. Chapter One (General Lawrence Bridge) describes the design of a major

new bridge to replace the existing bridge over the Mystic River. Chapter Two (Tenean Beach) evaluates the upgrading of a beach recreation facility at a highly-polluted location in Boston Harbor. Chapter Three (Three Charles River Bridges) reviews the design of repairs to three adjacent spans over the Charles River. Chapter Four (George's Island Pipeline) reports on an effort to repair a damaged water pipe between the town of Hull and George's Island.[3]

MDC management systems

It might be argued that the significance of these case studies is limited, since some were initiated years before the McKinsey report was commissioned; conceivably, the deficiencies observed during these projects may have since been remedied by the new McKinsey systems and procedures. However, three of the four projects are still in progress, and the fourth was not completed until June 1983 -- two years after MDC adopted McKinsey's recommendations. Thus, the events reported subsequent to 1981 do in fact reflect MDC's post-McKinsey operations.

In addition, it might be argued that since the case studies all involve Parks Division projects, the problems identified by these case studies do not necessarily exist in other divisions. However, many of these problems can be traced to MDC's central management systems, such as consultant selection, contract administration, and personnel management. It seems reasonable to conclude that the problems identified in the central systems have caused problems throughout all of MDC's operating divisions.

The second part of our study focuses directly on the current functioning of MDC's basic management systems, particularly the systems McKinsey addressed in

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[3] A fifth case study, which reviewed MDC's 11 year-long attempt to plan and build new zoo facilities at Franklin Park, was originally scheduled to be in this report. Instead, it was completed first and issued separately in order that its findings and recommendations would be available in time to be useful in the General Court's review of the fiscal 1983 capital budget. The zoo case study, which examined MDC's efforts to design and construct natural, animal, and educational exhibits for a tropical forest pavilion building, is perhaps the most unique, in terms of subject matter, of all five of the case studies; nevertheless, its findings and conclusions concerning the Parks Division's management problems closely parallel the findings and conclusions of the four case studies presented in this report.

its study;[4] this review considers the policies, procedures, organizational units, and results associated with the management systems, both in the Parks Division and in MDC's central administration. Were this review to find that the above agency-wide management systems are still deficient, in spite of the McKinsey report's recommendations, then it would seem reasonable to conclude that problems observed in all of the cases -- including those initiated prior to the McKinsey study -- could easily recur in MDC's future projects. And it would also seem reasonable to suppose that these same types of problems would be found in MDC's other line construction divisions.

Six management systems are reviewed. Chapter Five (Project Planning) reviews MDC's current performance in linking long-range planning to short-term project selection and design. Chapter Six (Consultant Screening and Selection) examines the policies and procedures MDC currently uses to select the design and engineering consultants who shape MDC construction projects. Chapter Seven (Contractor Prequalification and Selection) evaluates the methods MDC now employs to screen and choose the firms that construct the agency's projects. Chapter Eight (Project Management) reviews the numerous controls by which MDC presently attempts to ensure contract compliance with project time schedules, cost, budgets, and work specifications. Chapter Nine (Maintenance) assesses MDC's efforts to maintain its existing inventory of facilities. Chapter Ten (Personnel Management) reviews what is perhaps the most important single MDC management system of all -- the system by which MDC attempts to ensure that its personnel are qualified to carry out the agency's work.

The review of management systems entailed analyzing the McKinsey reports and implementation materials, interviewing MDC's top administrators, and observing the design and present functioning of the agency's management systems. Recommendations for strengthening MDC's current management systems are listed at the end of the chapter in which each system is reviewed.

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[4] The McKinsey report reviewed and made recommendations on all of these management systems except contractor prequalification and selection.

Conclusions and implementation

The third and final part of the report provides an integrated perspective on the findings and recommendations which precede it. Chapter Eleven (Implementation Strategies And Priorities) outlines the immediate actions which should be taken to begin achieving the needed improvements in MDC's management systems recommended in earlier chapters. Chapter Twelve (Conclusion) evaluates the scope and significance of the problems identified earlier in the case studies (Part I) and management system reviews (Part II).

PART I

THE CASE STUDIES

CHAPTER ONE

GENERAL LAWRENCE BRIDGE

Introduction

The General Lawrence Bridge, which carries MDC's Veterans Memorial Parkway across the Mystic River in Medford, was built in 1933. In 1973, MDC decided to replace the existing bridge with a new bridge. It was estimated that a conventional steel girder replacement bridge would cost $2.6 million. However, because of the bridge's location in the Mystic River recreational area, MDC chose a more expensive, but arguably more attractive, concrete arch design; one early estimate place the cost of constructing a concrete arch bridge at nearly $7 million. Somerville Engineering, Inc., was hired to design the bridge at a cost of $460,000, and design work began in 1975. It was estimated that the design would take about 18 months to complete.

Seven years later, in 1982, the design work for the bridge was still not complete. As a result of inflation, design problems, and the time delay, the cost of the Somerville contract had risen to $833,000, and it appeared that the final design cost might reach $1 million by the end of the project. Three million dollars in construction funds had also been spent on site preparation work; virtually all of this expenditure was made necessary by the unusual design of the bridge. The total cost of the bridge project was now estimated at $15 million. In August 1982, MDC decided not to continue with the concrete arch design; instead it decided to hire a new designer to design a conventional bridge.

The problems encountered on the General Lawrence Bridge project, and the concomitant waste of nearly $4 million in public funds to date, resulted in large part from Somerville Engineering's negligence and from MDC's inability to properly manage the engineering design process for a major structure. These problems and their underlying causes are documented on the following pages.

Finding 1.

The Decision To Replace The Bridge May Have Been Premature

In 1973, a consultant, Andrew Christo, was hired to evaluate the condition of the General Lawrence Bridge and to recommend a course of action. Christo submitted his report in July 1973, stating that the bridge had serious structural deficiencies. For example, he stated that the drawbridge mechanism "is totally inoperable and much of the machinery is no longer salvageable due to lack of maintenance." Christo recommended that the bridge be replaced; he estimated that a new steel girder bridge would cost $2.6 million, including design fees and contingencies. He also recommended that the new bridge be located about 300 feet south of the present bridge. This would prevent traffic disruption during construction and would also provide improved connections with the surrounding roadways.

But MDC apparently had decided to build a new bridge at least four months before the Christo report was received: in March 1973, a request for proposals (RFP) was issued for the design of a new bridge. It is not clear why MDC did not wait for the Christo report before making this decision, but the fact that the decision was already made could very well have influenced Christo's conclusions.

Finding 2.

MDC Failed To Study Design Alternatives

Once the decision was made to build a new bridge, good management practice would require MDC to study the various construction options available, including the attendant costs and benefits. There should also have been a determination of the specific requirements to be met, such as traffic capacity and the need for pedestrian and bicycle facilities.

A review of MDC files failed to disclose any such studies, nor did the person who was Chief Engineer at the time have any recollection of such work. Instead, MDC apparently decided it would look to the bridge designer for recommendations concerning the type of bridge to be built and the size and type of facilities to be included.

Finding 3.

The Designer Selection Process Was Inadequate

The design firm for the new General Lawrence Bridge was not selected in open competition. Instead, copies of the RFP were sent to four firms chosen by MDC; there is no documentation in MDC's files as to how these four firms were chosen. The RFP did not ask for any information on the qualifications of the design firms. Instead, it asked for preliminary design concepts and sketches. The invited firms were given four weeks to respond.

One of the invited firms, E.M. Khoury & Associates, refused to provide any designs or sketches. Khoury stated:

> "[T]o arbitrarily select one preferred design for any site, at the outset in the proposal stage of negotiations, without first conducting a complete and thorough investigation, is not in the best interest of the bridge to be designed...."

Instead, Khoury proposed an investigation, study, and evaluation of various types of bridge designs, followed by preparation of plans and specifications for the selected alternative. Khoury's proposed fee for this work was $35,000.

Somerville Engineering, on the other hand, provided not only sketches but also full-color renderings of a "sculptured three-hinged concrete arch" bridge. The Somerville proposal described its proposed design as "a simple bridge that creates a feeling of transparency and a hovering lightness that is a reflection of tomorrow here today." The proposal also included suggestions for sidewalks, a bicycle path,

plantings, and fishing areas. The complete rationale for these items was described as follows:

> "There was a time when children fished from this very bridge and the herring could be seen fighting the current to spawn upstream into the Mystic Lakes. I believe that someday soon, this Mystic River will once again support edible fish and this bridge should not just be designed for vehicular traffic but also, for pedestrian use....The bridge will not be just stone, steel and concrete but be a living structure which not only can be admired but also, used by people as well as vehicles."

The proposal did not include a cost estimate for the design or a proposed fee, nor did it discuss or analyze any other construction options besides this concrete arch. The proposal also failed to mention that there was no other bridge of similar design in the United States, and that this design had been based on a magazine account of a two-lane bridge built in 1941 in Czechoslovakia. The Czech bridge was constructed with reinforced concrete spans which were among the largest in the world. Moreover, it required a 138-foot clearance above the water because of the height of the surrounding area; there was no mention in the Somerville proposal of the possible technical problems which might result from using this design at the relatively flat Medford site where the required clearance above the water was only 16 and one-half feet.

Somerville's proposal also did not mention whether the firm had any prior experience in designing bridges; its statement of qualifications was limited to the assertion that "there is no one else in the New England area that can supervise the design of this type of bridge with a delicate balance of engineering and architecture as Tufts professor and member of our engineering staff Kentaro Tsutsumi." The proposal clearly implied that Professor Tsutsumi would manage the project, but this was misleading. According to Professor Tsutsumi, he was never a member of Somerville's engineering staff. Rather, he was an outside consultant who had been asked by Somerville to assist with the design concepts for the General Lawrence Bridge. He had never before done any work for Somerville, nor did he have any intention of managing this project. Moreover, Tsutsumi states that his design experience was limited to short-span highway bridges: he had never designed a working bridge of the size and complexity of the General Lawrence Bridge. (The staff designer whom Somerville Engineering did assign to the project

also had never designed any major river bridges prior to the General Lawrence Bridge.)

The Somerville proposal was accepted by MDC in August 1973. MDC files do not contain any information on why Somerville was selected or on the evaluations of the other bidders.

Although Somerville Engineering was selected in 1973, the contract was not signed and design work did not begin until 1975, due to negotiations with the Department of Public Works (DPW) over possible Federal funding for the bridge. But once the design work did begin, a long series of problems stretched the work out over seven years, with the end still not in sight.

Finding 4.

MDC Did Not Have Sufficient Technical Expertise To Supervise The Design Consultant

MDC did not and does not have anyone on its staff with sufficient technical knowledge to review the plans, specifications, and calculations relating to a complex bridge design such as that proposed by Somerville Engineering. This fact is readily acknowledged by various MDC officials, including the current project engineer for the General Lawrence Bridge, who is the manager of MDC's bridge program; the head of the Bridges and Highways section; and the Parks Division Director. The project engineer has stated that the General Lawrence Bridge design was beyond his expertise; moreover, the Parks Division Director maintains that his engineering staff generally does not have the expertise to review detailed design calculations even for smaller bridge projects.

An example of this lack of technical understanding is the belief held by some staff engineers that the high approach embankments for the new General Lawrence Bridge were needed to compact the soil. Actually, these high approaches were needed only because of the geometry of the arch design; the resulting weight of the approach embankments caused the soil problems, rather than solving them. Another example is the fact that when a consultant was selected to review Somerville's work, MDC's project engineer sent him an outdated version of the

design calculations. The project engineer did have the latest version of the calculations, but mistakenly believed them to be "back-up material" for the earlier versions of the bridge design.

This lack of in-house technical expertise is apparently of little concern to many Parks Division officials. They have stated that a lack of in-house expertise is precisely the reason that they hire outside consultants. One senior official stated that MDC pays "big dollars" for consultants, and because these are "competent professional firms," he believed it was appropriate to trust them to do a good job. Another staff member, when asked how he knew if a consultant was doing a good job, stated that "the proof is in the pudding," apparently implying that if the bridge as constructed does not contain any major defects, the consultant must have done a good job.

Finding 5.

MDC Did Not Attempt To Supervise The Consultant's Work

Very little effort was made to oversee consultants' activities during the General Lawrence Bridge project. Staff engineers who were assigned to the project did not have regular discussions with Somerville Engineering, did not establish deadlines for work products, and generally did not oversee the job in any systematic, detailed way. For example, it is MDC's practice to review design drawings before specifications are received, even though these two items are integrally related.

Even in approving invoices for payment, there was minimal oversight. A staff engineer checked hourly rates against the contract, but no effort was made to review the quality or quantity of the work performed. According to the Parks Division Director, he has never refused to pay a consultant's invoice.

Finding 6.

MDC Approved Early Designs Which Were Unnecessarily Elaborate And Expensive

The first cost estimate for the concrete arch design was prepared by Somerville in early 1976 and showed a total cost of approximately $10 million. This was in contrast to the original $2.6 million estimate for a conventional steel girder design. Considerable effort was spent in 1976 in looking for ways to cut costs, including trimming of design features which Somerville had included but which MDC then decided were unnecessary. For example, the original design included a 20-foot wide "planting strip" separating the two sets of traffic lanes. The design also included two sidewalks and a separate bikeway set off by a row of planters.

The Executive Office of Environmental Affairs (EOEA), during the course of its environmental impact review, described Somerville's inclusion of unnecessary items as "gold plating" designed to increase the size of the consultant's contract, and noted that "a more comprehensive problem statement would have been useful."

MDC finally decided that all it really needed to separate the traffic lanes was a four-foot median barrier, and the separate bikeway was combined with one of the sidewalks to save another eight feet in width. By the end of 1976, Somerville's construction cost estimate had been reduced by approximately one-third to $6.8 million.

Finding 7.

MDC Failed To Foresee And Prevent Major Technical Problems With The Early Designs

At this point, however, technical problems with the design began cropping up which ultimately would wipe out the cost savings just achieved.

Finding 7a.

Redesign of the arch proved necessary

First, Somerville realized that its concrete arch design required a fairly high bridge. One early version of the design provided a 26-foot clearance under the center arch, even though a clearance of only 16 and one-half feet was required for navigation. This high arch in turn required large embankments on both shores to bring the parkway up to the level of the bridge. But on the south side of the river, the parkway had to pass under Interstate 93. This created problems of excessive grade and inadequate clearance; the first design apparently allowed only seven feet of vertical clearance between the two roads, included a 22 percent grade (seven percent would be extremely steep for highways), and had other related highway safety problems. These problems were not even noticed by Somerville but were identified by EOEA, which characterized them as "embarrassing" for the consultant and for MDC.

To solve these problems, as well as to cut costs further, Somerville lowered the height of the bridge. But this, in turn, made it impossible to properly design the rounded arches originally envisioned. As a result, an entirely new structural design utilizing segmented arches had to be developed.

Finding 7b.

Soil settlement problems were overlooked

Even with the lowered height of the bridge, built-up approach embankments would still be required. Three years after the design was started, it was discovered that the weight of these embankments might cause the underlying soil to compress by as much as four feet. This settlement could have disastrous results if it occurred after the bridge was built. On Somerville's recommendation, MDC decided to pre-load the site, which involves piling large quantities of soil on the site to compact the ground before construction begins. This added at least $200,000 for additional soil studies to Somerville's design fees, and an estimated 18 to 24 months to the construction period. Sutton Corporation was hired in 1980

to do the site preparation at a cost of $3 million while Somerville continued to work on the actual bridge design.

Using a conventional steel girder design, the embankments could be lowered another 10 to 15 feet and still provide the necessary clearance over the river. Had such a design been used from the beginning, the soil settlement problems would have been much less severe, because the embankments would have been lighter. This, in turn, would have reduced or eliminated the need for the costly pre-loading.

However, since the pre-loading has already taken place, the recent decision to switch to a conventional design may actually result in additional costs for modification of the approach embankments to fit the new design.

Finding 8.

MDC Failed To Recognize That The Early Designs Of The Bridge Superstructure And Foundation Were Unsound

In October 1981, the staff designer responsible for the initial bridge design work left Somerville Engineering. At the time of his departure, he believed that the bridge design could be completed in two weeks, according to later interviews with the Inspector General's staff. The President of Somerville Engineering, who supervised this designer's work, also stated in interviews that he believed the design was close to complete at that time.

In fact, however, the staff designer who was hired by Somerville Engineering to review and complete the design discovered major problems with the existing designs of the bridge superstructure and foundation. First, the initial designs called for 300 foundation piles. The project files provide no explanation for the initial 300 figure, which would have furnished less than 50 percent of the foundation strength required by the bridge design. With 300 piles, the bridge would have soon collapsed under the weight of a normal load of traffic. The new designer subsequently increased the number of piles to 800.

Second, in the initial designs the pile caps were two feet deep. (The depth of the pile caps provides necessary anchorage for reinforcement of supports.) The depth of these pile caps, established by the American Concrete Institute, should have been four feet. The design was subsequently corrected.

Third, the initial design calculations for the foundation made no provision for "bending moment" forces, a key determinant of the quantity of steel reinforcement rods required by the bridge. The resulting estimates understated the number of rods required by approximately 50 percent. This error alone would also have caused the bridge to collapse within a relatively short time. The "bending moment" variable was included in the later Somerville calculations.

Fourth, the initial designs lacked moving joints at the roadway level, and also neglected to compensate for vertical uplift forces which had to be eliminated. Either of these errors would have caused the road to buckle, crack, and eventually deteriorate. In the later designs, roadway movement joints were added and uplift forces were eliminated.

And finally, the initial design significantly overstated the soil strength at the embankments. Since soil strength affects the size of the retaining wall required, this error alone could also have resulted in the eventual collapse of the roadway leading to the bridge. The later design calculations corrected the soil strength figures.

An internal memorandum written by the Somerville designer who inherited the initial designs indicates that by December 1981, the writer had identified the above defects, and had therefore discarded all of the previous design work on the bridge superstructure and foundation. In effect, the bridge design work had to begin all over again. Yet during the latter months of 1981, including December, the progress reports submitted to MDC by Somerville Engineering misleadingly stated that the bridge design work was over 90 percent complete. If MDC had been aware that Somerville intended to redo the bridge design work, MDC might have taken the opportunity to reevaluate the project. However, MDC apparently did not question or request evidence of Somerville's reported progress.

Finding 9.

The Most Recent Design Changes Paid For By MDC Are Technically Deficient And Unnecessarily Costly

A bridge must contain joints or similar mechanisms to accommodate expansion and contraction movements due to temperature changes. Without such joints, the structure is subject to cracking, which ultimately could lead to serious structural failures. The various Somerville designs for the General Lawrence Bridge originally failed to provide adequate joints. The most recent design changes prepared by Somerville in 1982 contain underwater hinges connecting the pile cap to the pier. Somerville's own design calculations show that these hinges are unnecessary, since the designs contain adequate movement joints at the roadway level. The underwater hinges are also unworkable: they will quickly fill with silt and their underwater locations make them virtually impossible to repair. The cost to MDC of these hinges is estimated at $150,000 for materials alone.

Finding 10.

MDC Approved Significant Design Fee Overruns

Accompanying these design problems were significant increases in Somerville's fee. The complete design effort was to have originally cost $460,000. In 1979, MDC approved a $244,000 increase. This increase was tied to the discovery of the soil settlement problem; Somerville said it needed the extra funds to pay for additional soil studies as well as to do the design work for the pre-loading contract.

In early 1982, Somerville asked for an increase of another $273,000, which would have brought the total design cost to nearly $1 million. In justifying this increase, Somerville stated:

> "It has been evident to us for some time that the present fee would soon run out and we would not be able to complete this project. This embarrassing situation has been brought to your attention orally, from time to time in the past....Perhaps the major factor leading to this request is the unique design of this potentially award-winning bridge. Because there is no other bridge like this in America, that we know of, many elements had to be designed from scratch instead of using the various 'standard manuals' as a guide. This 'extra research' consumed much more time than any of us were capable of estimating."

In short, Somerville virtually admitted that its staff did not know how to design the proposed bridge and were learning on the job.

Despite this admission, MDC granted part of the increase in May 1982, bringing the total design fee to $833,000. MDC apparently did not believe that Somerville should be held to the original terms of their contract. Rather, MDC decided that these extensive cost overruns should be paid for by the taxpayers, even if they were at least partially due to Somerville's inexperience. As of January 1983, actual payments to Somerville had reached $824,000, leaving only $9,000 unexpended.

Finding 11.

The Design Contract Provided For Excessive Overhead Rates

The Somerville contract stated that MDC would pay actual direct salary costs multiplied by a specified percentage for overhead and profit. Since the overhead and profit payment typically exceeds the payment for direct salaries, the determination of an accurate overhead rate is important in controlling costs. Most agencies which use such a provision specify that the contractor's overhead costs are subject to audit; if actual overhead costs differ, an appropriate adjustment is made. In the case of Somerville's contract with MDC, no such audit provision was made; a combined overhead and profit rate of 158 percent was established, with no provision for adjustments based on actual costs. A subsequent DPW audit of Somerville's overhead established a rate of 123 percent. Adding a typical profit

margin of 12 percent to this overhead would give a total rate of 135 percent, significantly below the 158 percent allowed by MDC.

A similar situation existed for one of Somerville's subcontractors, Geotechnical Engineering, Inc. Geotechnical submitted an overhead rate of 154 percent, which it claimed had been approved by a Federal agency. As a result, the 154 percent was included in the MDC contract, along with an additional 12.75 percent for profit. In reality, the 154 percent rate had been submitted to a Federal agency but had not been approved; the actual Federally-approved rate was 136 percent. Together, these excessive rates contributed to more than $50,000 in unnecessary costs for MDC.

Finding 12.

Potential Conflicts Of Interest Have Been Created

Geotechnical Engineering was the firm which provided various analyses of soil conditions to Somerville. These analyses were based in part on soil borings which were taken by another of Somerville's subcontractors, Guild Drilling. In 1979, Geotechnical recommended to Somerville and MDC that Guild conduct certain additional borings for an extra $16,000. Coincidentally, there was exactly $16,000 of unused funds left in Guild's contract.

After MDC approved these additional borings, Guild made a payment of $4,000 to Geotechnical for tests which Geotechnical conducted for Guild. Since Geotechnical was already under direct contract to Somerville to perform testing services, it is not clear why this additional payment was needed, but it appears to be a potential conflict of interest, because Geotechnical was paid by Guild with funds that it had helped obtain for Guild. According to Guild officials, MDC was not aware of this arrangement.

A similar situation occurred in 1980, when Geotechnical wanted to work with one of the bidders on the site preparation contract. This time, however, Geotechnical requested permission, which was denied by MDC because of the potential conflict of interest.

Thus it appears that MDC was relying on voluntary notification by consultants to identify potential conflicts of interest. Where such notification was absent, as in the 1979 situation, MDC apparently was unable to identify these problems through normal reviews of contract documents.

Finding 13.

MDC Was Slow To Identify And Respond To Contract Problems

The technical deficiencies, cost overruns, delays, and other problems described above had been cropping up almost since the project began. These problems should have justified a reevaluation of the design concept and of Somerville's qualifications to do the job. However, MDC has been extremely slow to realize and respond to the situation.

Between 1975 and 1980, there is no evidence that MDC ever seriously reevaluated the project. In 1976 the Chief Engineer raised the possibility of switching to a conventional steel girder design, and a similar suggestion was made by a staff engineer in 1977, but apparently the idea was not pursued in detail on either occasion.

There was also some criticism of Somerville's performance during this period. In 1976, EOEA included in its review of the bridge design the following pointed comment:

> "Since the consultant has unfortunately yet to demonstrate adequate proficiency in engineering design for this project, a significantly larger design burden must be placed on the Park Engineers who provide design review....The consultant apparently will have to make yet one more amended proposal submission in order to demonstrate engineering feasibility and reasonable cost estimates."

In 1981, the head of MDC's bridges and highways section asked another engineering firm to informally review Somerville's design because of its uniqueness and the fact that a bridge of this design had never been built east of the Mississippi River. This firm criticized various technical aspects of the design. At

this point, MDC staff requested and received formal permission from the Commissioners to hire a consulting firm to perform a detailed review of Somerville's work. A firm was selected to do this review and a contract prepared; Somerville, however, was permitted to continue with its work.

Then in 1982, before the independent review was started, the Inspector General began an inquiry into the General Lawrence Bridge project and the Somerville contract. In conjunction with that inquiry, the Inspector General's staff began reviewing design drawings and interviewing MDC officials. Shortly thereafter, a new MDC Commissioner reevaluated the project. This led to a decision, in August 1982, to cancel the Somerville design and to hire a new consultant to develop a more conventional design.

Finding 14.

There Has Been A Lack Of Accountability For The Project Within MDC

At MDC, project engineers play a key role in the supervision and oversight of outside consultants. It is the project engineer who is responsible for having day-to-day contact with the consultant, initiating recommendations, and bringing problems to the attention of top management. Top officials who must approve invoices for payment stated that they rely almost entirely on the project engineer to review an invoice's accuracy, but as noted above, very little is done by the project engineers in that regard.

Since 1980, the responsibilities of the project engineer on the General Lawrence Bridge project have been split between two staff engineers, and this situation continues through today. One engineer is officially designated project engineer, but basic duties such as approval of invoices have been assigned to the other engineer. According to MDC, this split responsibility was supposed to help balance the workload, but it has resulted in a lack of accountability. For example, each of the two engineers believes that the other is primarily responsible for overseeing Somerville's technical design work on the bridge itself. There is also disagreement on the reporting relationships; one engineer believes that he

supervises the other, while the other believes they both report directly to the head of the project management division.

A good example of the waste which is created by such a lack of accountability concerns Somerville's design activities in 1982. Somerville submitted a set of plans to MDC for review in 1980; however, MDC did not review them at that time because of its efforts to secure an outside consultant to assist in the review. The plans were finally reviewed by MDC and sent back to Somerville in late 1982. All MDC officials believed that Somerville was not doing any bridge design work during 1982 because they were waiting for MDC's comments. In reality, Somerville did a considerable amount of design work during 1982. By the time MDC reviewed the 1980 plans in late 1982, they were already out of date.

The fact that Somerville was continuing to work on the design during 1982 should have been obvious, since Somerville billed nearly $80,000 for design work during that period. But since no one felt responsible for questioning the invoices, and since no one was apparently asking Somerville about their activities, the costs went unchallenged. When asked about these costs, the Director of Parks, whose approval signature is on the invoices, did not even recall having paid them.

Finding 15.

Too Many Field Personnel Have Been Assigned To The Project

While supervision of Somerville Engineering was inadequate, the opposite problem existed with regard to Sutton Corporation -- too much supervision. Sutton was the contractor hired to do the soil preparation work at the bridge site. Most of this work was done between July 1980 and August 1982. During this time, MDC had four full-time field personnel assigned to oversee the construction, even though Sutton's work force typically averaged about 10 to 12 people and rarely exceeded 20. Two field staff would have been more than adequate for a job such as this; one person would even have been sufficient if overtime was available as needed.

From September 1982 to the present, there has been very little activity at the site, except for occasional visits by the contractor to perform specific maintenance items on the existing bridge. One field person working part-time would be more than adequate, yet during this period MDC has had three full-time field personnel assigned to the project. Because of a lack of anything to do, the field personnel have occupied their time in preparing construction documentation which should have been prepared while construction was in progress.

The Inspector General has estimated that this overstaffing resulted in more than $100,000 in unnecessary labor costs.[1] More importantly, it diverts personnel resources from other critical agency functions.

There appear to be at least two reasons for this overstaffing. First, there are no formal guidelines regarding the number of field personnel needed to oversee construction projects of various sizes; availability of manpower is a key factor. In addition, the weekly progress reports submitted by the field personnel do not provide sufficient information to judge their workloads, since the reports do not specify the project work items assigned to each field person. Accordingly, there is no one (other than the field personnel themselves) in a position to evaluate and adjust the staffing levels.

Finding 16.

MDC Staff Failed To Provide Adequate Information To The Commission

A final element in the inability of MDC to oversee this project has been an apparent reluctance on the part of the staff to bring problems to the attention of the Commission which might reflect adversely on decisions previously made by the Commission itself. In the case of the General Lawrence Bridge, it was the Commission which ratified the selection of Somerville Engineering and which on several subsequent occasions reaffirmed its support of the Somerville design. This fact was repeatedly cited by present and former staff members as justification for

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[1] This estimate assumes that MDC required two full-time field personnel during the period of construction (July 1980 through August 1982) and one half-time inspector in the post-construction period (August 1982 through April 1983), and that the annual cost (loaded) per inspector is $25,000.

continuing with the design and for not evaluating alternatives. For example, in 1979 the Chief Engineer asked the Deputy Chief Construction Engineer to review some design alternatives for the General Lawrence Bridge. In reply, the Deputy Chief Construction Engineer dismissed the suggested alternatives with a one-paragraph "analysis":

> "It has always been the Mandate of the Commission to replace the existing bridge with an architectural structure. Construction costs could be reduced by redesigning the proposed structure, elimination of concrete arch to steel stringers could save 1 to 2 million dollars; however, the 16.5 foot clearance over the river would still be required and continued maintenance of cleaning and painting would continue to be a problem to the MDC."

Moreover, there is a lack of independent information available to the Commissioners. The Commissioners rely on reports by senior staff officials, who in turn indicate that they rely almost exclusively on the project engineers' reports to identify problems or to approve decisions. If the project engineer is not keeping his superiors accurately informed, there is no independent mechanism (such as an internal audit or quality control function) to provide that information. Thus, it is easy to understand how a project such as this could be allowed to continue for so long in the face of such extensive problems.

In summary, the General Lawrence Bridge project was one in which MDC selected a design and a design consultant without adequate analysis or justification. The consultant was then permitted to work without close review or supervision. MDC appears to have been relying more on luck than on proper management to ensure a successful project.

Finding 17.

The Staff Analysis For The Recent Decision To Redesign The Bridge Was Inadequate

In August 1982, the MDC Commissioners withdrew their support for the Somerville concrete arch design. They directed the staff to hire a designer to

design a more conventional structure. On the surface, this decision apparently corrects a long-standing problem. In fact, the recent decision was marked by further serious lapses in management.

The presentation to the Commissioners showed a $5 to $6 million cost for a conventional bridge versus $11 million for the Somerville design. (Neither figure includes the $3 million cost of the site preparation contract.) No supporting detail was shown for either of these estimates; the staff engineer responsible for the estimates later said they were "rough" estimates based simply on square footage factors. It was also reported that the major disadvantage of a steel girder design was the need for periodic painting. There was no analysis or even mention of the various design alternatives (such as various types of concrete bridges) which could eliminate the need for painting, nor were the frequency and cost of painting estimated. The sole back-up document was a one-page, handwritten staff report.

Prior to the Commission's action, the Inspector General provided several suggestions on how MDC might proceed with its reevaluation. Specifically, the Inspector General recommended in writing that MDC:

- evaluate the costs and benefits of rehabilitating the existing bridge instead of constructing a new bridge;
- determine the amount of work which would be required to complete the Somerville design;
- determine what constraints, in terms of bridge design options, have been imposed by the site preparation and pre-loading work already performed; and
- obtain reliable cost estimates for any new designs being considered.

There is no evidence that any of these steps were taken. Instead, it appears that MDC has once again made a major decision without a complete analysis and factual evaluation of the alternatives.

Finding 18.

MDC Failed To Cancel The Somerville Contract

At the same time the Commission voted to let a new design contract for the General Lawrence Bridge, it also voted to complete the Somerville design. This decision may have been influenced by the fact that the Parks Director reported to the Commission that the Somerville design was 99 percent complete. In fact, Somerville had reported to MDC at that time that the final plans and specifications were less than 85 percent complete. Among the incomplete items were the final cost estimate; compilation of material quantities; specifications for roadway lighting and drainage; data for bearings and expansion joints; construction sequence; and requirements relating to the demolition of the old bridge.

When asked about this discrepancy, the Parks Director said he did not think the difference between 85 percent and 99 percent was particularly significant. But in fact, to complete the Somerville design, given its actual status, would cost at least another $150,000, according to change order requests submitted to MDC by Somerville.

Whether or not Somerville will actually complete the design is in some doubt. The former MDC Commissioner stated that Somerville was not supposed to finish its work, but that it was unnecessary to tell Somerville to stop work because the Inspector General's subpoenas had effectively stopped it anyway. He later added that the only work they were supposed to complete was the abutment design, which would be needed anyway for the new bridge design. These statements are difficult to reconcile with the Commission's vote to have Somerville complete all project plans and specifications. The project engineer stated that Somerville was supposed to finish the design, but he had not thought about where the money to pay for it would come from. (As previously noted, there is very little money left in the Somerville contract.) The head of the bridges and highways section said the only reason for Somerville to finish was to be able to show the Inspector General that MDC had received something for its money. The Inspector General quickly responded in writing to this last comment, noting that the continued expenditure of funds to complete the Somerville design, in the face of a decision not to use the

design, was an absolute waste of money. Nevertheless, MDC has still not communicated any clear policy decision either to its staff or to Somerville.

Finding 19.

MDC Lacks A Consultant Evaluation Process

Finally, it should be noted that Somerville itself could have (but did not) submit a proposal for the new design contract for the bridge. There has been no formal effort to evaluate Somerville's performance on this project. In 1979, Somerville received another contract from MDC for design work on the Three Charles River Bridges project. (See Chapter Three of this report.) Even today, the Parks Division Director still believes that Somerville could be qualified to obtain additional MDC contracts.

In short, the latest events surrounding the General Lawrence Bridge project show a disheartening failure on the part of the Parks Division to learn from their past problems and mistakes. Instead, the project continues to be hampered by a lack of management accountability and control.

CHAPTER TWO

TENEAN BEACH

Introduction

The General Lawrence Bridge case (Chapter One) documented MDC's inability to manage the design of a complex, multi-million dollar project. It might be argued that the many problems experienced in this case occurred because the design was unique and the project was atypical. But the same cannot be said for this case study -- a small, straightforward park rehabilitation project.

Tenean Beach is a 15-acre MDC reservation fronting on Boston Harbor in the Dorchester section of the City of Boston. The beach is the reservation's primary recreational facility; other facilities include a children's playground, basketball courts, rest rooms, and a parking area.

In 1978, the MDC Commission approved a rehabilitation project for Tenean Beach. The rehabilitation was estimated to cost $300,000 and was to include upgrading the playground and basketball courts, building new tennis courts, adding more plantings and lighting, and constructing a promenade walkway between the parking lot and the beach.

Five years later, in 1983, the project has not yet been finished. The construction contractor walked off the job in 1981 and filed suit against the Commonwealth, alleging deficiencies in the design and management of the project. A new contractor has been hired, and the total estimated cost of the project has now risen to nearly $900,000, three times the original estimate.

Finding 1.

MDC Undertook Redevelopment Of The Beach Without Adequately Addressing The Serious Pollution Of Its Waters

Proposals for redevelopment at Tenean Beach date back to the early 1970's. In 1972, the Commission endorsed the concept of additional development at Tenean. In 1974, MDC Commissioner Sears stated:

> "I feel no hesitation in saying that we deem any activity in [Tenean Beach] which leads to park construction or improvement, including swimming and boating, to be safe, sound, and an altogether reasonable use of taxpayers' funds."

In 1978, the Commissioner formally approved hiring an architect for a redevelopment project.

Throughout most of the seven-year period during which additional development of Tenean Beach was being proposed, the beach was unfit for swimming. The pollution problem at Tenean Beach is largely caused by overflows from the Boston City and MDC sewer systems, due to pipe blockages and heavy rainstorms. Additional pollution results from storm conduits carrying run-off from nearby Conley Street, Morrissey Boulevard, and the Southeast Expressway. These problems were widely publicized in the press as early as 1969. In July of that year, in response to high pollution levels, MDC was forced to close the beach for the rest of the summer, causing a public outcry. In 1972, the beach was again closed for a short period when pollution levels were deemed unsafe for swimming. These pollution problems have persisted to the present.[1]

Given these chronic pollution problems, the decision to invest additional money in the facility should have involved a major information gathering and planning effort. One would have expected MDC to have studied carefully and in detail the costs and benefits of rehabilitating the site -- the costs in terms of dollars and

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[1] MDC has now scheduled an $8 million project to design and construct two screening and disinfection facilities to abate sewer overflow discharges into Dorchester Bay. The project, scheduled to begin in December 1983, will affect both Tenean and Malibu Beaches.

the effect on public health, and the benefits in comparison with the benefits of investing in other types of recreational facilities. Alternatives to the use of Tenean Beach should have been identified and evaluated: for example, construction of a public swimming pool at the beach to be used when the ocean pollution levels were excessive.

Apparently no such comprehensive study was ever undertaken. Although modification of some of the sewer discharge pipes in order to lower the water pollution level at the beach was briefly studied in the early 1970's, no action was taken. MDC also commissioned a consultant study, issued in 1980, which documented the sources of pollution within MDC's service area, including Tenean Beach. However, MDC appeared to all but ignore the question of pollution while it proceeded with plans to redevelop the beach site.[2]

Finding 2.

The Designer Selection Process Was Inadequate

In 1978 the Commission authorized selection of an architect for the Tenean Beach redevelopment project. The architect was not selected in open competition. Instead, copies of the request for proposals (RFP) were sent to five consultants who were recommended by an in-house Consultant Selection Committee created by MDC's Chief Engineer.

Responses to the RFP were evaluated by this Selection Committee. There was no pre-established grading system for the evaluations; each reviewer used his own system. Some used numerical scores, while others merely made qualitative

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[2] In 1982, the MDC Commission adopted official water quality standards. However, MDC's standard for bathing waters permits a 250 percent higher level of pollution than is currently recommended by the United States Environmental Protection Agency (EPA). (MDC's standard for bathing water is 500 fecal coliforms per 100 milliliters of water, whereas EPA's standard is 200 fecal coliforms per 100 milliliters of water.) When asked to justify MDC's far more lenient water quality standard, an official from the agency's environmental quality section, who helped to develop that standard, could furnish no stronger argument than to say that a stricter standard would require MDC to post warning signs at too many beaches.

comments. As a result, it is unclear from the ratings why one consultant was selected over the others.

According to one member of the Selection Committee, a major consideration was MDC's unofficial policy of spreading the work among the consultants with whom it routinely did business. According to this official, the design contract for Tenean Beach was awarded to John Wacker & Associates in large part because it was "their turn." At the time of the contract award, another State agency -- the Department of Environmental Management (DEM) -- was experiencing substantial site problems on a project which John Wacker & Associates had designed. However, there is no evidence that MDC contacted DEM to obtain information regarding Wacker's performance prior to the Tenean Beach contract award.

Perhaps the most glaring omission in the designer selection process was the consultant's failure in his proposal to address the site's flooding problems. Dealing with flooding conditions was one of the most critical design elements of the project. The RFP specifically stated:

> "The Tenean Beach site is threatened with overwash by sea at high tide and heavy seas. It is important that every firm considering this proposal take this environmental factor into consideration at this time."

Despite this explicit warning, neither Wacker's proposal nor any of the other proposals addressed this critical issue. MDC's apparent lack of concern in this regard would ultimately lead to even greater problems.

The design contract with John Wacker & Associates was signed in July 1979, with a maximum fee of $41,200. The contract indicated that the project's entire cost was not to exceed $300,000, including the designer's fee. The commence work order was given in September 1979, with a construction start scheduled for August 1980.

Finding 3.

Poor Performance By MDC Caused Project Delays

Although most of the Tenean Beach site was owned by the Commonwealth, the rehabilitation plan required the acquisition of four small parcels of privately-owned land. These parcels, totalling slightly more than one acre, were to be acquired by MDC using its power of eminent domain. However, when MDC staff presented its formal beach redevelopment proposal to the Commission in 1978, along with the budget request for $300,000, no mention was made of the need to acquire land, nor of the potential acquisition cost.

In early 1979, MDC's Right-Of-Way section estimated that the land acquisition would cost $125,000, including relocation expenses. MDC was not able to find a funding source to pay for the land until April 1980, and the necessary legal proceedings and relocation activities were not completed until early 1981.

In addition to acquiring the land, MDC also agreed to prepare a topographic survey of the site using its own field personnel. This is a practice MDC typically follows in its design contracts to save money on consultants' fees. But on this particular project, MDC failed to produce the necessary survey on time. It was not furnished until August 1980, and even then contained numerous errors and omissions which required additional survey work.

Partly as a result of these delays, MDC was not ready to put the project out for bid until March 1981, nearly seven months after construction was originally supposed to begin. In addition, Wacker requested an increase in design fees, noting:

> "The major time delays this project experienced, due to land-taking and delivery of topographical survey have resulted in increased costs...to the consultant and create the need to request an increase in the basic services fee."

Finding 4.

MDC Approved Major Scope Changes Which Lacked Justification And Increased Project Costs

After Wacker was hired and had started work on the design, MDC began to reconsider the initial design. MDC decided to tear up the existing parking area, despite its good condition, and relocate it. The children's play area and basketball courts were also relocated and increased in size. The proposed promenade walkway was replaced by a 1,000-foot long granite wall. Together, these changes raised the estimated design and construction costs from $300,000 to $500,000, a 66 percent increase.

Although these design changes were presented to the Commission, there was no analysis of their costs. Rather, the new design presentation primarily consisted of drawings and renderings showing the extent of the proposed project. In addition, there is no evidence that anyone questioned why these changes in scope had to be made.

The lack of scrutiny given to these changes is illustrated clearly by the granite wall. Wacker estimated that this wall would cost $40,000, yet it is not clear even today what its purpose or function is. MDC first proposed the wall as a barrier to prevent flooding of the parking lot, and MDC's project engineer still believes that to be the wall's primary function -- despite the fact that there are openings in the wall for pedestrian access every 20 feet or so. The project engineer states that wooden logs would be used in the openings to hold back the tides. Wacker, on the other hand, maintains that the wall is primarily aesthetic and provides seating for park users. Wacker also asserts that he told MDC that a wall large enough to prevent flooding was out of the question because of MDC's budget constraints. Another MDC engineer who reviewed the specifications noted that if the wall was supposed to be a water barrier, the logs would soon be dislodged by tidal action or removed by vandals.

Not all of the design changes were initiated by MDC; Wacker proposed large increases in the use of plantings. A horticulturist hired by Wacker as a subconsultant criticized these expanded planting plans, noting that the proposed grass areas would require irrigation, periodic fertilization, and restricted usage to

prevent damage from salt spray and expected foot traffic. He recommended instead a much reduced planting program that would be compatible with the exposed beach nature of the site. But the MDC project engineer rejected the horticulturist's recommendations, choosing instead the more elaborate plantings proposed by Wacker. The engineer explained that the public, which had been demanding improvements at Tenean Beach, was "in no mood for a barren area." The engineer added that he did not even bring the horticulturist's concerns to the attention of the Commission, fearing he would be "thrown out of the room."

As a result of the design changes, along with the delays described above, Wacker's contract was increased in February 1981 from the original $41,200 to $51,200, a 24 percent increase.

Finding 5.

The Design Did Not Adequately Address Flooding Problems

Perhaps the most serious deficiency during the design phase was the failure of both Wacker and MDC to take into account periodic tidal flooding of the site. This failure is difficult to understand given the explicit warning in the RFP (previously quoted) which called attention to the problem.

The topographic survey prepared by MDC showed a high water mark at elevation 9.75 feet. According to MDC's field survey supervisor, this mark was determined by looking at the seaweed line on the day the survey was taken. Further survey work was not done because MDC's field staff were not told the purpose of the survey. Consequently, they were unaware that plantings and playgrounds were planned for the site and that flooding was an important design consideration.

According to the U.S. Army Corps of Engineer's standard chart of flood tide data for Boston Harbor, the highest tide each year reaches about four feet higher than the "high water mark" identified by MDC's survey. The Corps' tide data also

shows that at least every ten years the highest tides reach another two feet higher.

Wacker Associates said it was not aware that the Corps' data existed; and that it relied on the MDC data, despite the fact that Wacker was contractually responsible for researching environmental conditions. The result of this design error is that a large area of the park (including plantings, play areas, walkways, and the parking lot) will be subject to periodic flooding by corrosive salt water.

Finding 6.

MDC's Poor Project Planning And Weak Oversight Of The Contractor Contributed To Construction Problems

Finding 6a.

MDC's bid analysis was insufficient

Construction bids were opened on April 15, 1981, and a contract was awarded to the low bidder, Arborist Construction Company, at the bid price of $501,229. Arborist was directed to begin work in May; completion was now scheduled for the following November.

The 1,000-foot granite wall, whose purpose had never been clarified during the design phase, caused major problems during construction. Arborist included less than $10,000 for this wall in its bid, compared to Wacker's estimate of $40,000. The next two lowest bidders each bid approximately $100,000. Wacker pointed out this extreme discrepancy in its bid analysis and suggested that MDC review Arborist's bid to determine if it contained errors or omissions. There is no evidence that MDC followed up on this suggestion.

After construction began, Arborist apparently realized it would not be able to provide the granite wall at its bid price. It made several attempts to substitute a less costly type of granite, but MDC steadfastly refused to accept any substitution and insisted that the original specifications be met. Arborist then claimed that the

specifications were unclear and demanded an additional $95,000 to complete the wall.

Finding 6b.

MDC failed to resolve the contractor's poor progress and cash problems in timely fashion

From almost the beginning Arborist's work on the project was slow and sporadic. Frequent inspections during the summer by both MDC and Wacker personnel showed very slow progress, and it soon became clear that the November completion deadline could not be met. Despite repeated inquiries by MDC officials, the contractor apparently did little to rectify the situation.

In addition, Arborist apparently was having difficulty in making payments to its subcontractors. Two of the subcontractors filed requests for payment directly with MDC; requests were also filed with Arborist's bonding company.

Despite the passage of some five months during which time progress toward completing the contract was clearly inadequate, and despite MDC's knowledge that the contractor was having cash flow problems, MDC apparently made no effort to terminate and rebid the contract.

Finding 6c.

MDC's unclear management organization for the project contributed to delays

MDC acknowledges lengthy delays in providing its approval of items submitted by Arborist. Whether these delays actually held up the project is subject to question; nevertheless, it is clear that the ability to process approvals in a timely manner is a key aspect of sound project management. At least part of MDC's problem in this respect related to a lack of clear delegation of authority. Five different staff members were involved, to one degree or another, in supervising the Tenean Beach project; submittals may have gone to any one of the five. Apparently, no one person had clear responsibility in ensuring that approvals were

obtained in a timely manner. This situation was exacerbated by a major MDC reorganization in the summer of 1981, during which the Construction Division was eliminated and responsibility for the Tenean Beach project was transferred to the newly-created Parks Division.

Finding 6d.

MDC failed to hold up progress payments to Arborist despite contractual problems

Despite pronounced schedule delays and other problems evident during construction, requests for payment from Arborist were routinely paid by MDC. Out of a contract total of $501,000, a total of $171,000 was paid. In fact, a request for payment for $38,000 was approved by MDC on October 27, 1981, a week after MDC had received a letter from Arborist's attorneys describing contractual problems. The failure of MDC staff to hold up progress payments under such circumstances is difficult to understand.

Finding 7.

Additional Construction Problems Have Led To Litigation

In October 1981, Arborist stopped work on the project. Subsequently, the contractor filed a lawsuit against MDC, asking for payment of $570,000. Arborist's suit alleges that periodic flooding of the site prevented construction from proceeding. However, according to MDC's resident engineer, no flooding occurred until after Arborist stopped work. Arborist also charges that MDC failed to approve transmittals within 30 days, as required by the contract. MDC acknowledges that many approvals were indeed delayed, partly because of the major reorganization taking place at the time. However, MDC argues that most of the transmittals were not critical items and that work on other items could have continued. MDC also claims that Arborist never indicated that the lack of approvals was causing a problem until late in the summer. Arborist charges that

MDC prevented Arborist from using the existing parking lot for construction storage. However, the contract specifically required that the park be kept open for public use during construction. In response to these allegations, MDC officially terminated Arborist's contract for breach, and filed a claim with Arborist's bonding company.

Because of pending litigation, it would be inappropriate to offer any conclusions at this time as to who ultimately was at fault in the cancellation of the Arborist contract.

Finding 8.

MDC Failed To Reevaluate The Project Prior to Awarding A New Contract

After Arborist stopped work and filed suit, Wacker began to prepare a new set of plans and specifications to permit a new contract to be awarded to finish the work. Some changes were made in the design, including shortening the granite wall by 200 feet. However, there was apparently no reevaluation of the basic need for this wall, even though it was obvious by now that its cost would approach $100,000. In addition, the basic problem of periodic flooding on the site still remains.

In December 1982 a new contract was awarded to Carroll Construction for $483,000. This brought the total estimated cost for the project to $887,000, including $51,000 for Wacker's design contract, $182,000 for land acquisition, and $171,000 paid to Arborist prior to cancellation of their contract. Because the land acquisition and the Arborist contract are in litigation, and because the design and construction itself are still in progress, further cost increases are possible.

Construction was scheduled for completion in July 1983; however, the new contractor has requested a six-week extension. In addition, MDC staff are considering a plan to delay the project planting until the spring of 1984.

CHAPTER THREE

THREE CHARLES RIVER BRIDGES

Introduction

This case study involves another relatively simple and straightforward project -- repairs to three bridges spanning the Charles River between the Brighton section of Boston and Cambridge near Harvard Square: the Larz Anderson, Western Avenue, and River Street Bridges. In 1978, MDC initiated procedures to procure design services, and in 1979 a consultant contract for $146,000 was awarded to Somerville Engineering, the firm which was also designing the replacement of the General Lawrence Bridge for MDC. The consultant's repair specifications were approved in August 1981 and a $500,000 construction contract was awarded in April 1982.

Four and one-half years after the project began, the repairs on two of the bridges were finally completed; however, MDC was forced to stop work on the River Street Bridge due to problems encountered during the construction period. Costs incurred to date on the Three Charles River Bridges project have exceeded $725,000 for design and construction, compared with $550,000 originally budgeted. Final costs will be much higher, because new contracts for reinspection, design, and repair of the River Street Bridge have not yet been let. The causes of the delays and overruns on the project are examined in the following section.

Finding 1.

Because MDC's Bridge Inspection Program Was Inadequate, MDC Was Forced To Hire A Consultant To Identify Bridge Repairs Needed

MDC first inspected the three Charles River bridges in 1972 when it instituted a formal bridge inspection program, and subsequent inspections were conducted in 1975 and 1978. All three inspections identified substandard conditions on each of these bridges. However, the ratings and comments contained in the 1978 bridge inspection reports for the three bridges focused entirely on the condition of the bridges' roadways; they failed to address the condition of the arch structures and structural concrete supporting the bridges.

In 1978, the Commission approved a $550,000 project for repairs to the three bridges; $50,000 was slated for the design contract and the remainder was for construction. Since MDC's own inspections were considered inadequate to determine exactly what repairs were needed, it was decided to have the design firm conduct more detailed bridge inspections prior to designing the repairs needed by the three bridges.[1]

Finding 2.

The Designer Selection Process Was Inadequate

Under the Consultant Contract Guidelines approved by the MDC Commission in 1978, a Consultant Selection Committee used a screening process to select at least three design firms to receive copies of the request for proposals (RFP). It was the unofficial policy of the Chief Engineer to invite at least five firms to propose. When proposals were received, they were evaluated by the Committee and a final recommendation was made to the Commission.

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[1] The practice of having a designer both identify a problem and propose its solution leads to an obvious conflict of interest, because the more problems the designer identifies, the larger the design fee.

MDC's designer selection process, as used on the Three Charles River Bridges project, had several deficiencies which created the risk that the best qualified firm for the job would not be selected.

Finding 2a.

The initial screening decision was not documented

The Director of Parks Engineering recommended nine consultants, from which five were to be sent copies of the RFP. But when the list of five was issued, only one of the originally-recommended nine was included. This process raises several questions:

- On what basis were the original nine recommended?
- Why were eight of the original nine rejected?
- On what basis were four other firms, not on the original list, added?

Review of MDC records revealed no answers to these questions.

Finding 2b.

The number of proposals received was insufficient

Five firms were preselected to submit proposals for the Three Charles River Bridges project, based on the Parks Engineering Director's belief that five invitations would result in submission of five competitive proposals representing a cross-section of proposed methods. However, only three firms responded to the invitation, restricting the Consultant Selection Committee's choices.

Two individuals in positions of authority over the project, the Chief Engineer and the Director of Parks Engineering, both felt it was not important to solicit additional proposals. Another member of the committee, however, did say they should have invited additional proposals; he said he felt he had little choice in his final selection and that the selected consultant was "dumped" on him.

Finding 2c.

Criteria unrelated to merit were used to screen consultants

Central to MDC's consultant screening process is an assumption that the firms subsequently invited to submit proposals will be qualified to do the work. Qualifications were judged on the basis of Selection Committee members' personal knowledge as well as the information submitted by the consultants.

The screened list for the three bridges project, however, contained one firm whose qualifications were at least questionable -- Somerville Engineering, the firm which was already experiencing difficulties in designing the replacement for the General Lawrence Bridge. One member of the Committee stated that he had voiced concerns during the screening process about Somerville's performance on the General Lawrence Bridge in 1976 and 1977. He had complained that the plans were inappropriate for the site, that sight-distance and approach safety were inadequate, and that the bridge grade was excessive. He had also observed that the consultant was slow to respond to suggested design changes. However, despite this member's concerns, Somerville appeared on the screened list of consultants.

In addition, Committee members stated that a major objective in the consultant screening process was to "spread the wealth" -- that is, distribute work evenly among the consultants. It was felt to be unfair to award a few consultants a disproportionate amount of work. Committee members also believed that the likelihood of poor performance or missed schedules would increase if a consultant were overburdened with MDC work. Thus, the Committee reviewed the amount of MDC work each consultant was performing and used this information to screen firms.

Spreading the wealth does not necessarily serve the interests of MDC or ensure fairness to consultants. Screening consultants on the basis of the amount of their current MDC work will not ensure that work will be done properly and in a timely manner; a review of all active contracts held by the consultant from all sources would be necessary to accomplish this objective, but such information was neither required nor considered by MDC. In any event, despite MDC's supposed

spread the wealth policy, the contract for the three bridges project was awarded to a firm which already held a $400,000 design contract for another MDC project.

Finding 2d.

The evaluation criteria used were inconsistent

In November 1978, the three prospective designers submitted their proposals. Each Committee member reviewed the proposals individually and ranked them in order of preference. The evaluations were made using forms containing 14 criteria as prescribed in MDC's Consultant Contract Guidelines.

A review of the Committee's evaluation forms revealed several deficiencies in the evaluation system. First, members made individual choices about whether or not to rate proposals in terms of the 14 factors prescribed by the Commission. Two of the five members chose not to rate consultants on some of the questions on the form. One member did not rate one of the three proposals on two important factors: the general technical competence and specialized experience of the firm, and the quality of the proposal including its completeness of presentation.

Second, each Committee member used his own scale for responses. In some cases, one-word answers were used; in others, brief explanations or observations were noted. Some members used more detailed scales (such as excellent, very good, good, fair, poor), while others used limited scales (such as good and poor). As a result, each evaluator held the proposals to different standards.

Finally, Committee members considered factors which should not have influenced their decisions. According to the 1978 Consultant Contract Guidelines, each proposal was to be evaluated and ranked on the basis of its technical approach as well as the firm's qualifications and prior performance. After the evaluation process, the Division Director was to be responsible for negotiating fees with the top-ranked firm. (If an acceptable fee could not be negotiated, the Director would negotiate with the second-ranked firm, and so forth.) However, during the selection process for the Three Charles River Bridges project, the Committee considered the consultants' proposed fees -- which ranged from $149,000 to $274,000 -- in ranking the proposals. The Director of Parks Engineering later said that he had requested fees in the proposals only to obtain an estimate of the

project's difficulty and to provide a basis for negotiating a fee. He added that fees should not have been a consideration in ranking the proposals. (A preferable practice in this regard is to have fee proposals submitted separately from the technical proposal.)

Nevertheless, four of the five Committee members noted fees on their evaluation forms, and one member criticized a proposed fee as excessive. One member later said that he would consider costs in any evaluation of technical merits if the differences were substantial. Another member made it clear that he considered price: he said he felt compelled to rank the selected proposal first partly because another firm had proposed such a high fee. This same Committee member reported that he felt he could not rank another firm highly because it had not done work for MDC. Only one member noted potential problems with the first-ranked consultant's previous performance on the General Lawrence Bridge, but he said he felt he had no real choice in his selection and ranked the consultant first.

These three problems -- inconsistent use of evaluation factors, use of different rating scales, and consideration of inappropriate factors -- resulted from the inadequate guidance given the Consultant Selection Committee for evaluating proposals. The only guidance given to the Committee members was the listing of the evaluation factors.

Finding 3.

The Consultant's Fee Was Not Justified

In June 1979, the Commission gave final approval to a $146,000 cost-plus-fixed fee contract with Somerville Engineering for the three bridges project. Somerville's scope of work included a two-step process: 1) investigate the type and extent of needed bridge repairs, and 2) design the needed repairs. Prior to accomplishing the first step, MDC had no way of accurately determining the scope of the second step and hence had no basis or justification for determining the fee.

In early 1978, the Commission had earmarked $550,000 for the consultant and construction contracts for repair and rehabilitation of the three bridges. There is no documentation indicating how this figure was determined or justified. According to Somerville's structural engineer on the project, it is very difficult to make an accurate design fee estimate without knowing the extent of the problems.

Somerville's original proposal presented two different fees: one for $128,500 and the other for $165,000. (According to the proposal, the actual price would depend on the amount of time a senior engineer would have to spend on construction consultation.) It is not clear how the negotiated contract price of $146,000 was reached.

MDC's Director of Parks Engineering stated that before negotiations for a contract took place, he would estimate a cost based on reports of the structures' condition, and that he would consider the information consultants had given him in their proposals concerning the man-hours needed to do the work. Obviously, it would be to a consultant's advantage to overstate the degree of difficulty entailed in the project in order to obtain a higher fee.

Finding 4.

MDC's Failure To Perform Timely Reviews Of Consultant Submittals Caused Significant Project Delays

The design phase of the Three Charles River Bridges project was beset by a number of problems. The first major delay occurred in signing and approving the contract. The Consultant Selection Committee evaluated the three consultant proposals for the project in November 1978. It was then necessary to select a consultant, negotiate a contract, and receive various approvals required by statute. It was not until August 1979, almost a year later, that this process was completed and notice was given to the contractor to proceed. Reasons for this delay were not documented.

Once work had begun, it was expected that the design of the repair work would be completed within nine months. In reality, it took 24 months; the design documents were not completed until August 1981.

A major factor in this delay was MDC's failure to perform timely reviews of the consultant's submittals. For example, in July 1980, the consultant submitted 75 percent complete construction documents to MDC and estimated that the project could be ready for competitive bidding by September 30, 1980. Not until February 1981 did MDC hold a meeting to review the 75 percent submittals with the consultant. According to the Parks Division Director, MDC planned this delay to ensure proper weather conditions for placement of concrete and mortar. However, when the head of MDC's bridges and highways section was asked why seven months had elapsed before MDC reviewed the submittals, he stated that MDC manpower shortages often resulted in delays of this nature.

Finding 5.

MDC's Failure To Ensure Adequate Bridge Inspections Caused MDC To Underestimate The Need For Extensive Bridge Repairs

Finding 5a.

MDC neglected to specify adequate inspection methods to be used by the consultant

MDC failed to ensure that the consultant would employ "hands-on" inspection methods to determine the nature and extent of the problems below the surface of the bridges. MDC's own in-house inspections of the three bridges had been primarily visual. When the scope of services of Somerville's contract was negotiated, it also required visual inspection. No specific requirements were included for special tests to determine the extent of deterioration. In fact, the contract's scope of services was extremely vague regarding additional tests:

> "The visual inspection and preliminary structural evaluation results will be used as a guide for testing and additional inspection and as a basis for design of the required repairs."

As a result of this vague requirement, the consultant did not sample the concrete for possible deterioration and used hands-on inspection methods only in easily accessible areas at the shoreline. As a consequence of these methods, Somerville significantly underestimated the nature and extent of the deterioration of the three bridges, as discussed in Finding 5b.

Finding 5b.

MDC failed to reinspect the bridges prior to construction

Somerville's visual inspection of the bridges took place during September and October of 1979. The consultant subsequently noted in a progress report dated December 17, 1979:

> "It is recommended that all repairs, whether structural or of a maintenance nature, be performed without delay. If repairs are not carried out, deterioration will take place at an accelerating rate, necessitating much more extensive repairs at a future date."

However, because of the delays during the design period, the bridge repair work did not begin until April 1982 -- two and one-half years after Somerville's inspection. MDC did not reinspect the bridges during the long interval between the visual inspection and the award of the contract for construction.

Soon after starting repair work on the bridges, the contractor discovered bridge deterioration of a far more severe nature than described in the contract specifications. For all three bridges, concrete cracking was four times as extensive as anticipated in the contract specifications. Patches of concrete deterioration were at least twice as extensive as MDC had anticipated. In addition, for the River Street Bridge, Somerville's visual inspection had failed to identify severe deterioration of the keystone and arch structure; the contractor subsequently discovered that the arches for the River Street Bridge needed extensive rebuilding.

Despite the long delay between Somerville's inspection and repair work, it is highly improbable that this extensive deterioration could have all taken place after Somerville's inspection, according to an engineering expert on the Inspector

General's staff. Because concrete deteriorates very slowly, most of the deterioration discovered by the contractor would probably have been revealed two and one-half years earlier if MDC had required Somerville to conduct a hands-on inspection of the three bridges.

In addition, if MDC had thoroughly reinspected the bridges prior to letting the construction contract, MDC might well have discovered the problems described above. However, MDC's project manager stated in interviews that he had discounted reinspection as a viable option, on the grounds that reinspection would have required that he obtain a contract amendment and go before the Commission to request more money, activities which MDC did not have time to do. In addition, he had not believed that the bridges required reinspection.

MDC approved change orders of $80,000 for additional repair materials required by the contractor, who completed the repairs of two bridges -- the Larz Anderson and Western Avenue -- in the spring of 1983. However, due to the nature and extent of deterioration discovered when construction began on the River Street Bridge, MDC decided to let a new contract to reinspect the bridge and design the repair work required. As of June 1983, this contract had not yet been awarded.

CHAPTER FOUR

GEORGE'S ISLAND PIPELINE

Introduction

MDC's Parks Division is responsible for maintaining George's Island, on which the historic Fort Warren is situated. The water source for the island, a 6,000-foot cast-iron pipeline between the town of Hull and the island, was constructed by the U.S. Army in 1941. In recent years, water service to the island has been interrupted frequently by numerous breaks in the pipeline.

MDC commissioned the Tibbetts Engineering Corporation to review options for furnishing George's Island with a reliable water source in 1972, and again in 1978. In late 1981, MDC undertook a project to repair the cast-iron pipeline. The project involved inserting a new four-inch plastic pipe through the old ten-inch cast-iron pipe, a method referred to as sliplining. The contract called for six steps to be completed: 1) any debris or sediment in the old pipe that would prevent the new pipe from passing through was to be cleared, to ensure the feasibility of the subsequent tasks; 2) a 38-foot section of the plastic pipe was to be pulled through the length of the cast-iron pipe to ensure that the plastic pipe would not be damaged in the sliplining process; 3) the entire 6,000-foot length of plastic pipe was to be inserted; 4) the plastic pipe was to be coupled at the two termini; 5) the pipeline was to be pressure-tested; and 6) the pipeline was to be disinfected before being placed into service.

MDC thought the project would be simple: the project cost was estimated at $65,000, and the project schedule was one month. These estimates would prove unduly optimistic; in fact, project costs exceeded $300,000, and the waterline repairs were not completed until June 1983 -- 17 months after the project began. The events contributing to the project overruns and delays are chronicled in the section which follows.

Finding 1.

The Contract Specifications Prepared By MDC Ignored The Tibbetts Report Findings

The 1978 Tibbetts report to MDC, entitled "Investigation of Water Main to George's Island, Phase II -- Long Term Solution," cited sliplining as one repair option available to MDC, but warned that the cast-iron water pipe might require realignment, prior to inserting the four-inch plastic pipe, in order to correct deflections that could obstruct the sliplining process. Notwithstanding the Tibbetts report, MDC's contract specifications did not note that the contractor might encounter deflections in the ten-inch pipe, nor did the specifications prescribe procedures to be followed by the contractor in the event that deflections encountered were sufficiently severe to require realigning the existing pipe prior to inserting the new pipe. Moreover, the 1978 Tibbetts report was not made available to prospective bidders, who therefore had no reason to question the adequacy of MDC's contract specifications. MDC's failure to anticipate and make provisions for the pipeline deflections discussed in the Tibbetts report would lead to major conflicts with the contractor regarding the scope of work defined by the contract.

Two other aspects of the contract were inconsistent with the Tibbetts report findings. The report stressed the importance of protecting any portion of the pipeline which was not buried under the sand, because "[t]he existing watermain has a history of breaks which are directly related to its exposed condition on the harbor bottom." As subsequently designed by MDC, however, the pipeline project did not provide for a protective covering of the exposed pipeline. The project engineer, who was responsible for designing the project and developing its contract specifications, could not recall why the protective covering was omitted from the project, and no documentation for the decision has been found.

Finally, the contract document compiled by MDC listed the first two work items in reverse order: the test insertion of a 38-foot section of pipe was listed as item 1, and cleaning the pipe was listed as item 2. Fortunately, the contractor chose to ignore the order of work steps prescribed by the contract.

Finding 2.

MDC's Project Cost Estimate Was Unjustifiably Low

The 1978 Tibbetts report estimated the cost of the sliplining project at $185,000, not including the cost of the protective covering omitted by MDC and contingency funds. However, MDC records show an estimated project cost of only $65,000. The project engineer does not now recall how MDC's $65,000 estimate was derived. He states that a graduate engineering student intern compiled the estimate and that he, the project engineer, never questioned the difference between the student's estimate and that contained in the Tibbetts report.

MDC advertised for bids in September 1981. On October 19, 1981, two bids were received: one was for $136,500 and the other was for $84,500. MDC accepted the low bid from Inner Space Services, Inc., a contractor which had previously done repair work on the George's Island pipeline for MDC. Parks Division staff apparently did not analyze the reasons for the price variation between the two bids received, nor the fact that MDC's estimate, as well as both bids, were significantly below the Tibbetts estimate.

Finding 3.

MDC Selected An Inexperienced Contractor For The Project

Inner Space Services, Inc. had never before worked on a project which involved sliplining. The prequalification application Inner Space submitted to MDC listed two prior projects in Maine which entailed laying pipe under water, but made no mention of sliplining. Nevertheless, MDC awarded the contract to Inner Space.

Finding 4.

MDC's Initial Project Schedule Was Unrealistic

On December 1, 1981, the Parks Division Director instructed Inner Space to begin work on December 14, 1981, with a completion date of January 13, 1982. In his letter, the Director noted that an extension of time would only be granted under extraordinary circumstances. On December 21, Inner Space requested an extension, citing "inclement weather" and "extreme cold." The engineering staff concurred with the contractor's request, and the Commission granted the first contract extension, to May 28, 1982. (The project would not ultimately be completed until June 1983.) In view of the fact that inclement weather and extreme cold are typical of mid-December conditions, there appears to be little justification for the Commission's decision -- one week after the project had begun -- to extend the project for five months because of the wintry weather conditions.

Finding 5.

MDC Authorized The Contractor To Use Work Methods Which Caused Blockages In The Pipeline

Finding 5a.

In attempting to clean the pipeline, MDC authorized the contractor to use work methods which caused blockages

The contractor began work to clean the pipeline in February 1982. During that month, by using water pressure, the contractor was able to feed a light, 1/8-inch nylon line from one end of the pipeline to the other. The contractor's subsequent efforts to pull through a heavier, 7/16-inch braided rope failed: the

rope jammed within the pipeline. The contractor then removed both the nylon line and the rope from the pipeline, and attempted, by using water pressure, to reinsert the 7/16-inch rope attached to an Aqua Crisscross Pig, a cleaning apparatus. In other words, the 7/16-inch rope which the contractor attempted to push through the pipeline using water pressure was the same rope that they had been unable to pull through the pipeline when attached to the 1/8-inch nylon line. Not surprisingly, both the rope and the "pig" became jammed approximately 1,800 feet into the pipeline.

Finding 5b.

In attempting to clear the blockages, MDC authorized the contractor to use work methods which caused further blockages

The next day, the contractor attempted, using water pressure, to push a series of funnels and a cotton swab through the pipeline, in the hope that the funnels and swab would dislodge the rope and pig. Not surprisingly, the funnels and swab became jammed behind the rope and pig.

A more appropriate procedure would have been to attach a 1/8-inch steel cable to the 1/8-inch nylon line and pull it through the pipeline. Subsequently, cables of gradually-increasing diameters should have been attached to the nylon line and pulled through the pipeline until the cable was large enough to clean the pipeline and to allow insertion of the four-inch plastic pipe.

Finding 6.

MDC Staff Instructed The Contractor To Perform Work Unauthorized By Either The Contract Or The MDC Commission

In March 1982, after the cleaning apparatus had become stuck in the pipeline, the contractor concluded that the likelihood of additional obstacles to insertion of the four-inch plastic pipe into the pipeline was high. In a letter to

MDC dated March 29, 1982, Inner Space noted the difficulties, and stated:

> "...we have in fact met the basic requirement of item No. 1 & 2. That the pipe has some obstacle that would prevent, without further investigation, a problem in the installation of a full length [four-inch] polythylene pipe." [sic]

The contractor asserted that any additional work deemed necessary by MDC would be outside the scope of the existing contract.

Upon receipt of the contractor's March 29 letter (excerpted above), MDC might have chosen to terminate the contract. Instead, MDC staff took the position that Inner Space had not completed the first two contract items, and instructed Inner Space to continue work. On April 22, 1982, the contractor -- acting on MDC's instructions -- ordered 6,000 feet of the four-inch polyethylene pipe. The pipe was delivered on May 29, 1982, one day after the expiration date of the contract extension which the Commission had granted in December. State regulations require that all contract work be performed under a current contract or contract extension. Nevertheless, MDC's project engineer instructed the contractor to continue work despite the absence of a new contract, contract extension, or Commission authorization. In response to MDC's instructions, the contractor began inserting the four-inch pipe in order to pinpoint the location of the jammed pig, funnels, and swab. (The length of rope inserted in February was not considered an accurate measure of distance from the shoreline to the obstruction, because the rope had apparently become tangled up within the pipeline. Because the plastic pipe was less flexible, it was believed more effective as a distance measure.) On June 8, 1982, the contractor began inserting the four-inch pipe.

The plastic pipe then became jammed and the contractor determined that the obstruction was located approximately 1,400 feet from the Hull shore. However, despite repeated diving attempts, the contractor was unable to locate the cast-iron pipe under the sand.

MDC then authorized Inner Space to hire a subcontractor to perform a "sub-bottom profile" -- a technique which employs sonar sounding to plot the location of buried metal on a graph -- to locate the pipe. MDC also authorized Inner Space to rent a barge and crane in order to excavate the pipe located in the profile. (The contractor's tugboat was used to pull the barge and crane.)

On July 1, over a month after the second contract extension had expired, Inner Space submitted another project extension request to MDC. (MDC requires that the contractor do so prior to approval by the MDC Commission.) In a memorandum to the Commission Secretary dated July 9, 1982, the Parks Division Director recommended that Inner Space be granted the project extension from May 28, 1982 to October 28, 1982. On July 22, 1982, the Commission voted to approve the second contract extension.

On July 23, the contractor excavated and "tapped" the cast-iron pipe -- that is, drilled a hole in the pipe and inserted a probe to locate the four-inch plastic pipe -- but failed to find the plastic pipe inside the larger pipe. Assuming that they had excavated beyond the location of the obstruction, Inner Space moved toward the shoreline and made several more excavations on the pipe; again, they failed to find the plastic pipe inside the cast-iron pipe. The next two excavations revealed the plastic pipe. However, when Inner Space moved away from the shoreline again and excavated the pipe, the plastic pipe was still missing.

Inner Space had marked the location of the earlier excavations with a buoy marker. On August 3, Inner Space returned to the site of the buoy marker and excavated 15 feet to one side of the marker. This excavation revealed the existence of a second cast-iron pipeline running parallel to the pipeline on which the earlier excavations had been made. The braided rope and plastic pipe were located on these excavations, indicating that this second pipeline was indeed the pipeline under repair. The contractor's failure to locate the plastic pipe on the earlier excavation was then explained: those excavations had been made on the wrong pipeline, which apparently was no longer in use. Because the pipeline being worked on was buried several feet deeper than the abandoned pipeline, the initial sub-bottom profile had received signals only from the higher, unused pipeline. Despite the contractor's efforts during those weeks of excavation, the pig, funnels, and swab were never located.

On August 12, 1982, the project engineer instructed the resident engineer to suspend operations while MDC reconsidered its course of action. MDC officials held several meetings to review options. Based upon a meeting on August 31, 1982 attended by the Parks Division Director and the MDC Commissioner, the project engineer informed the resident engineer that if the contractor could complete the

project by the fall, he could proceed; otherwise, the contract would have to be rebid the following year.

On September 7, the contractor was told to demobilize; however, this decision was subsequently reversed.

Finding 7.

MDC Selected A New Approach Without Sufficient Analysis

MDC staff then decided to pursue a new approach whereby the contractor would leave the inserted four-inch pipe in place on the Hull side, exit the ten-inch pipe to avoid the obstruction, lay the plastic pipe outside the cast-iron pipe along the channel floor, and reinsert the plastic pipe into the cast-iron pipe on the George's Island side of the obstruction. The exposed pipe was to be anchored to the channel floor with 100-pound concrete blocks at five-foot intervals. This approach had been recommended by the contractor, who told the MDC Commission that Inner Space had completed a project using a similar approach in Boothbay Harbor, Maine. MDC's Contract Administrator contacted the site in Maine and received confirmation that the work performed by Inner Space had been successful. However, the Contract Administrator apparently neglected to inquire about the specifics of the project approach used in Maine. In fact, the project had simply consisted of laying pipe, secured to concrete blocks, along a channel floor; no sliplining had been involved.

In addition, MDC decided to use 100-pound blocks as anchors for the plastic pipe without analyzing their adequacy for that purpose. The 1978 Tibbetts report had cited swift currents and other possible hazards in the channel as threats to the pipeline. Nevertheless, neither the project engineer nor the resident engineer made any calculations of the weight that would be necessary to hold the pipe in place under the severe conditions expected in the channel.

Finding 8.

MDC Staff Understated To The Commission The Amount Of Extra Work Already Performed By The Contractor

In a September 10, 1982 memorandum, the Parks Division Director told the Commission that the new approach would require an extra work order of $150,000. The memorandum made no mention of the staff's decision in June to allow extra work payments, nor of the fact that a portion of the $150,000 would actually pay for work already done to locate the obstruction. The minutes from the September 16, 1982 Commission meeting indicate that the Parks Division's Director of Project Planning and Management verbally informed the Commission that extra work totalling approximately $80,000 had already been completed by the contractor. In fact, the Inspector General's analysis of the invoices submitted by the contractor for extra work performed between March 29, 1982 and September 17, 1982 shows extra work totalling approximately $106,000. MDC would later pay Inner Space an additional $70,000 which appeared to be compensation for the extra work performed during this period.

Despite the fact that the requested extra work order was almost twice as large as the original contract and that MDC staff had violated Commission policy by authorizing substantial extra work without Commission approval, the MDC Commission voted, three to one, to approve the $150,000 extra work order on September 16, 1982.

Finding 9.

MDC Failed to Prepare Specifications For The Remaining Work

Under the terms of the extra work order approved by the Commission, the contractor was to be reimbursed for time and materials. Handwritten notes from a meeting of MDC officials on August 16, 1982 indicate that the project engineer was

responsible for developing a set of specifications governing the contractor's work. (Presumably these specifications would have defined the materials to be used as well as the procedures to be followed in laying the plastic pipe and in exiting and entering the ten-inch cast-iron pipeline.) However, no such specifications were produced. As a result, the materials and methods to be used were left to the discretion of the contractor; no document was in place to hold the contractor accountable for the subsequent performance of the pipeline.

Finding 10.

MDC Staff Again Instructed The Contractor To Perform Work Unauthorized By The MDC Commission

During the fall of 1982, the contractor transported sections of the plastic pipe to George's Island, and conducted diving activities there to locate the cast-iron pipeline. The second contract extension granted by the Commission expired on October 28, 1982; nevertheless, the contractor continued work under the supervision of MDC staff. From November[1] until the following March, the contractor worked on the project without a Commission-approved contract extension. On March 14, 1983, the contractor submitted a contract extension request, and on March 24, 1983, the Parks Division Director submitted a memorandum to the Commission requesting approval of a contract extension from October 28, 1982 to May 31, 1983. The Commission approved this third contract extension, and then rescinded it shortly thereafter. Despite this recission, the contractor completed work on the pipeline in June 1983.

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[1] On October 16, 1982, the contractor's barge and crane tipped over, hitting the tugboat. As a consequence, the barge, crane, and tugboat sank. Work on the pipeline was delayed until November 15, 1982.

Finding 11.

MDC Staff Consistently Failed To Document The Agency's Directives And Decisions

Throughout the project, MDC staff failed to document decisions affecting the project and directives to the contractor. For example, on March 29, 1982, the contractor wrote a letter to MDC's project engineer concerning a meeting which had taken place on March 26, 1982. Among other things, the contractor's letter noted that excavation work at Hull would be outside the contract's scope and that it was his "understanding from our meeting that such work has received your Agency's consent." However, MDC files contain no record of such consent. Without documentation of key project decisions, MDC's accountability for and control over such decisions are undermined.

Finding 12.

MDC Staff Repeatedly Circumvented MDC's Contract Procedures In Authorizing Payments To The Contractor

Finding 12a.

MDC's partial payment to the contractor violated contract provisions

The contract specified that Inner Space would receive a lump-sum payment of $35,000 for contract item 1, the test insertion of the plastic pipe. As noted earlier, during the spring of 1982, MDC staff repeatedly disputed the contractor's claim that item 1 had been completed. On June 11, 1982, the supervisor of resident engineers sent a memorandum to the Parks Division Director reaffirming the staff's position but suggesting that MDC might make a partial payment to Inner Space for contract item 1, if MDC's General Counsel determined that such a payment was legal:

> "I cannot agree that the contractor has, in fact, accomplished the work under Item 1 because very simply, the 38[-foot] test section of [four-inch] diameter polyethylene pipe was never inserted and run through the [ten-inch] C.I. main....
>
> However, it does seem that the contractor, in his efforts to perform the work under Item 1, could expect at least a partial payment. As of this date he has been paid nothing. I suggest that a legal opinion, with respect to such a payment under Item 1, is in order."

MDC's first payment to Inner Space, approved on June 11, did include $17,500 for item 1 -- half the lump-sum amount specified in the contract -- in violation of the contract provisions.

Finding 12b.

MDC staff backdated the first payment

According to the payment estimate prepared by the resident engineer and approved by the project engineer, the June 11 contract payment covered work performed from December 4, 1981 through May 27, 1982. However, this payment included $8,100 for insertion of 1,350 feet of four-inch pipe, an activity which was not begun until June 8, 1982. When asked about this discrepancy, the resident engineer stated that because the contractor had been working for five months without pay, MDC staff wanted to get a payment to him. He stated that he had "backdated" the estimate to include work completed after expiration of the May 28 contract extension. It was necessary to backdate the payment, he said, because a new extension had not yet been granted.

Finding 12c.

MDC paid the contractor for work that had not been done

The contract specified that Inner Space would be paid contract item 2, clearing the pipeline of debris, at the rate of $1.00 per linear foot of pipeline cleared. Included in the June 11 payment to Inner Space was $1,350 for this

contract item, based on the fact that Inner Space had successfully inserted 1,350 feet of plastic pipe. MDC's second payment to Inner Space, approved on September 2, 1982, included $4,650 for the balance of contract item 2 -- that is, for clearing the remaining 4,650 feet of the pipeline. In fact, Inner Space had not cleared the pipeline beyond the initial distance of 1,350 feet.

Finding 12d.

MDC made payments to the contractor without adequate justification

Inner Space's invoices for work authorized under MDC's $150,000 extra work order did not identify the specific work for which the payments were requested. Moreover, MDC's payments to Inner Space bore no discernible relationship to the amounts Inner Space invoiced. From September 20, 1982 through October 15, 1982, for example, Inner Space's invoices to MDC totaled $35,094, yet MDC's payments to Inner Space for work performed from September 18, 1982 through October 15, 1982 totaled $105,965. Analysis of the resident engineer's daily logs for that period indicates that it was unlikely the contractor could have incurred costs of anywhere near $105,956. It therefore would appear (as discussed in the previous Finding 8) that MDC's payment of approximately $70,000 was intended to compensate the contractor for the extra work which was performed in the spring of 1982 without the Commission's approval.

Seventeen months after the George's Island sliplining project was begun, water was successfully delivered to the island via the new pipeline. It now appears that the total cost of the pipeline project will exceed $300,000 -- at least $66,000 more than MDC's appropriation. Given MDC's willingness to pay Inner Space for work not done, work done without a contract, and work done without documentation, it seems fortunate that the overrun was not higher.

PART II

MDC MANAGEMENT SYSTEMS

PART II

MDC MANAGEMENT SYSTEMS

Part II evaluates the extent to which the deficiencies described in the preceding case studies are symptomatic of larger system-wide problems. For all but one of the six MDC management systems reviewed in Part II, the 1981 study by McKinsey & Company, Inc. proposed detailed new policies and procedures. For the five areas addressed by the McKinsey report, Part II also evaluates the extent to which MDC has implemented the most important of the McKinsey recommendations.

CHAPTER FIVE

PROJECT PLANNING

Introduction

In an organization as large and active as the MDC, effective and efficient performance requires continuous, systematic planning. The scope of the planning effort needed includes far more than individual projects and current activities. Such concrete concerns must be addressed in terms of broader contexts -- such as the agency's general goals, its explicit objectives, its present and projected resources (including personnel, as well as funding and equipment), its priorities, its ongoing and evolving programs, its organizational structure, and other means through which the agency defines and pursues its mandate. In short, MDC should have a comprehensive planning system which integrates the agency's operations. This planning system should continuously strive to ensure, over time, that the actions the agency takes in the present reflect and further its fundamental purposes.

Planning at MDC was a primary focus of the 1981 management study conducted by McKinsey & Company, Inc. According to the McKinsey final report:

> "Systematic master planning and program development [at MDC] are virtually absent, thus reducing the ability to select, coordinate, and move forward toward overall objectives."

The case studies presented earlier all illustrate and corroborate McKinsey's finding that MDC lacked a cohesive planning system. For example, MDC decided to build the new General Lawrence Bridge (Chapter One) without analyzing the available repair and construction alternatives; rather, MDC relied on the bridge designer to recommend the size and type of bridge to be built. (The design subsequently proved unworkable.) In the Tenean Beach case (Chapter Two), MDC embarked on a beach rehabilitation project without examining the implications of the chronic pollution levels of the beach waters. (These pollution problems continue to plague Tenean Beach.) And in planning the George's Island Pipeline repair project (Chapter Four), MDC ignored the key findings of a consultant report commissioned

by MDC several years earlier. (This omission contributed to major schedule delays, cost overruns, and conflicts with the contractor.)

The following section evaluates the extent to which MDC's implementation of the McKinsey report's planning recommendations has corrected the planning deficiencies evident in the projects described in the case studies.

McKinsey's Recommendations On Project Planning

The McKinsey report recommended that strong planning functions be institutionalized at the division level, and that MDC's central Planning Office be responsible for overseeing the divisions' planning activities. The McKinsey report further recommended that MDC adopt a formal planning process whereby:

- Master plans, prepared by MDC's central planning officials, state the Commission's goals, policies, and program priorities which will serve as the policy framework for all MDC planning activities at the division level.

- Program plans, prepared by division management for each program area (e.g., bridges) specify each program's objectives, criteria for selecting projects to further program objectives, a set of proposed projects, and project justifications.

- Project justifications, prepared by division engineers, describe alternative project approaches, evaluate the costs and benefits of each project alternative, recommend a preferred alternative and outline a plan for implementing the recommended alternative.

MDC also commissioned McKinsey to prepare a user's manual for MDC planning personnel. The manual, entitled MDC Planning System Manual, describes in detail the recommended procedures for reviewing and updating master plans; preparing program plans; selecting projects, budgeting and scheduling; and periodically reviewing the divisions' progress toward meeting its program plans' objectives.

Upon completion of the McKinsey study, according to MDC officials, MDC reorganized the planning functions within the agency in accordance with the study recommendation. In July 1981, former MDC Commissioner Terrence J. Geoghegan stated in a memorandum:

> "The reorganization has institutionalized a clear planning process which has developed programs and projects from the division level up so that every project which the MDC is going to undertake in the next two years is specifically called out in their planning manual. It gives specific dates, estimated costs, source of funds, and the project engineer responsible. All of the projects are tied to specific

programs. Every engineer has his time allocated to projects for the next year. All this planning was arrived at by division people who have specified their needs and been [sic] discussed and approved in open Commission meetings...."

Geoghegan's successor, former MDC Commissioner Nylen, also asserted in an interview with the Inspector General's staff that the McKinsey planning system was fully implemented and working well. In fact, however, the Inspector General's review of the process by which the Parks Division today plans programs and selects projects reveals that the planning system designed for MDC by McKinsey has been implemented only in appearance. The Parks Division has adopted some of the McKinsey forms and procedures, but systematic master planning and program development continue to be absent, as shown in the findings which follow.

Finding 1.

Despite McKinsey's Emphasis On The Importance Of Master Plans, They Remain Ineffectual

Updated master plans are necessary, according to McKinsey, to:

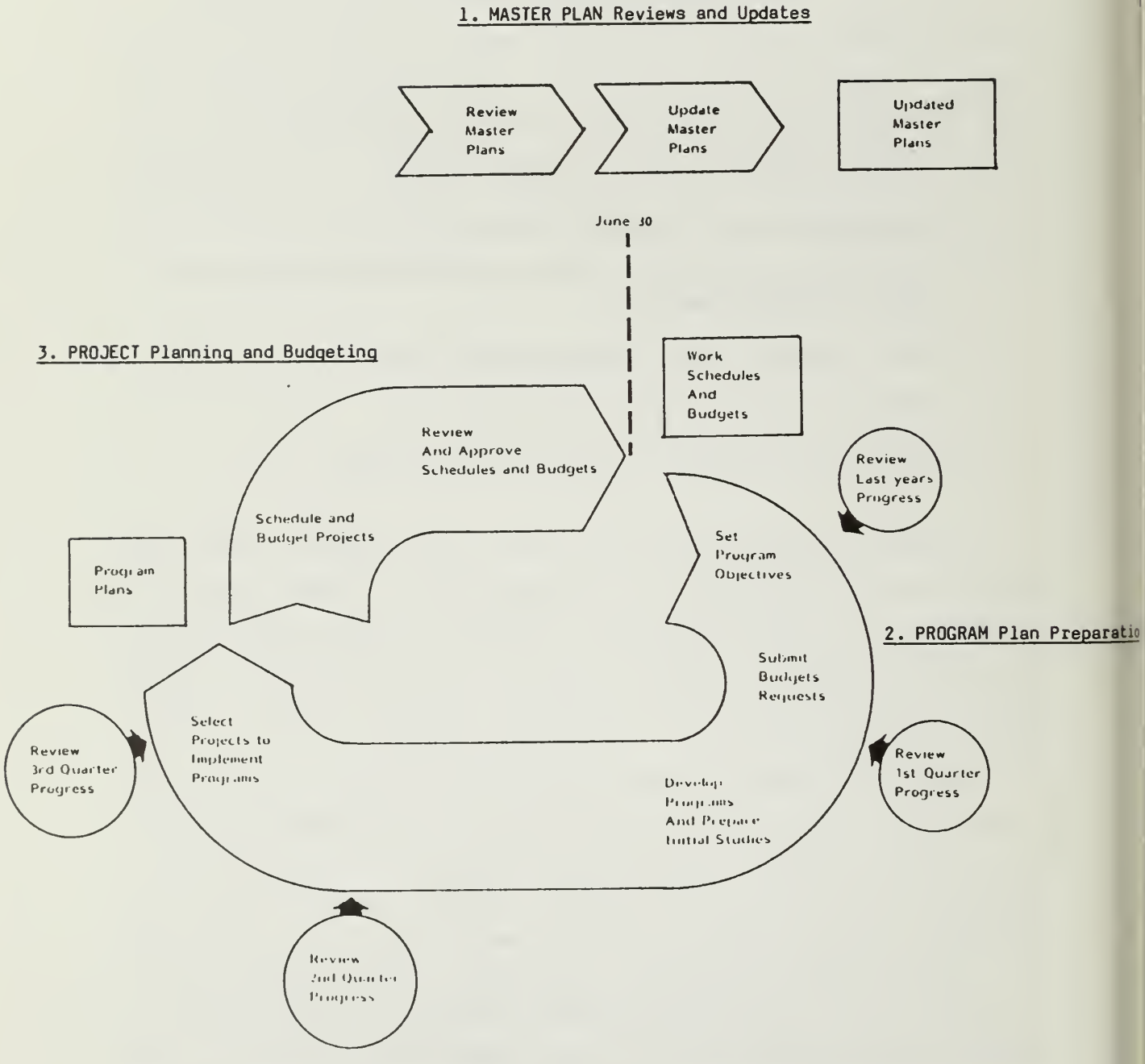
- ensure that essential projects are started on time;
- anticipate the need for long-life facilities;
- determine the most economic configuration and capacity level for systems with high fixed costs;
- provide a framework for evaluating costs and benefits;
- convince the public to support MDC projects; and
- generate ideas to improve the quality of MDC services.

The 1981 McKinsey report notes, however, that "because...[MDC] Master Plans are not up to date and part of a planning system, no division uses them to select projects." To rectify this deficiency, the McKinsey manual outlines standards and procedures designed to ensure that MDC's master plans provide a workable policy framework and guide for each division's program activities. Figure D depicts the master planning system recommended by McKinsey.

According to McKinsey, a master plan consists of a comprehensive statement of agency goals and objectives as well as a plan for meeting agency goals over a 10- to 20-year period. To be useful as a guide for all subsequent steps, a master plan must clarify key assumptions regarding population changes, new technologies, and social values; it also must link the agency's long-range policies to its day-to-day operating decisions. Since changes in the environment and in the Commission's values could alter key planning assumptions and desired policies, the McKinsey planning system calls for an annual review of all master plans by MDC's Planning Office; plans found to be deficient would be systematically updated, either by the Planning Office or by a consultant. Every master plan update would

Figure D

McKinsey Master Planning System



Source: A Recommended Planning System For the Metropolitan District Commission (New York: McKinsey & Company, Inc., March 2, 1983), n. page.

require Commission approval. The manual anticipates that master plan updates will be required every three to seven years.

MDC has not adopted McKinsey's recommended master planning procedure; its master plans thus continue to be of little value. According to MDC's Planning Director, two master plans for the Parks Division exist. The first, "Parks-Reservations-Recreational Facilities Development Program," was prepared for MDC by Edwards, Kelcey & Beck Consultants in 1956; it has not been updated over the past 27 years. (The 1956 plan revised an earlier master plan prepared in 1892.) This plan addressed MDC's long-range objectives with regard to reservations and recreational facilities throughout the jurisdiction of the Metropolitan Parks Commission; it did not address other Parks Division program areas such as bridges, roadways, and river basins and streams. The second master plan, "Open Space for Metropolitan Boston," was prepared in 1969 by the Metropolitan Area Planning Council (MAPC) under a United States Department of Housing and Urban Development (HUD) grant; MDC provided partial funding. The MAPC plan also analyzed long-range policy issues with regard to reservations and recreational facilities throughout Metropolitan Boston, although specific sites were not listed. Like the 1956 plan, the MAPC plan contained no discussion of bridges or roadways within MDC's jurisdiction. According to MDC's Planning Director, this plan laid out projects subsequently undertaken in two of the four MDC districts. The 1969 plan has not since been revised. The Planning Director indicated that her office is currently examining the 1956 plan to determine which portions require updating.

According to the Parks Division Director and the Director of Project Planning and Management for the Parks Division, the two master plans cited above have no effect on the development of the Parks Division's program plans or the selection of its projects. Absent the long-range policy framework that an updated master plan should provide, MDC lacks the capability to systematically adapt its projects and activities to changes in demographic patterns, environmental conditions, technologies, service level demands, and other factors affecting programs carried out at the division level. The impacts of this deficiency on the Parks Division's other planning activities are discussed in the findings which follow.

Finding 2.

The Allocation of Parks Division Resources To Programs And Projects Is Uninformed, Arbitrary And Vulnerable To Abuse

The McKinsey planning manual makes each MDC division responsible for preparing program plans which identify and describe projects to be undertaken within each program area over two fiscal years. In response to McKinsey's recommendations, the Parks Division allocated all division projects to ten program areas: land acquisition, coastal beach and shore management, river basins and streams, reservations, specialized facilities, sports facilities, buildings and grounds, parkways, bridges, and energy conservation. A program manager was assigned to each program to monitor the progress of the projects contained within the program.

The McKinsey manual also states that each program plan must specify:

- clear, specific objectives which are linked to the program outlined in the division's master plan;
- the criteria used to include or exclude projects from the program plan;
- project justifications and estimated project impacts on the program objectives; and
- an implementation plan for each project.

The process prescribed in the McKinsey manual for developing division program plans is as follows. First -- prior to the development of any program plans -- the division would draw up a tentative list of each program's objectives; this list would be reviewed and approved by the Commission. Next, the division would prepare alternate priority rankings of all its programs, and of the projects within each program, to illustrate the programmatic impacts of alternate resource allocation priorities. For each project thus identified, a project justification would be prepared comparing the project's costs and benefits to those of alternative project approaches. After reviewing the division's project justifications within each of its

program areas, the Commission would select and give preliminary approval to one set of program plans, thereby establishing the amount of resources to be allocated to the division. The division would then complete its program plans by adding detailed project information where required. Finally, the division would present a final two-year plan for all its program areas to the Commission for approval.

In March 1982, the Parks Division compiled a two-year plan listing the division's ten programs, their objectives, and the active projects contained within each program; this document is updated annually. However, as the findings which follow show, the process of developing this two-year division plan bears little resemblance to the procedures described above.

Finding 2a.

Project selection decisions are unguided by prior written program priorities and selection criteria

According to Parks Division officials, Parks Division projects are usually selected by the Division Director, with input from other division officials. Project requests and suggestions are compiled from a variety of sources, including division officials' observations during periodic district site visits; statutory mandates; requests from MDC Commissioners, State legislators, and community groups; recommendations from division program managers and district superintendents; and emergencies. Division officials consider these requests and suggestions, decide which projects should be accorded priority, compile the projects selected, and then prepare the program plan, which is presented to the Commission.

As a consequence of the process summarized above, allocation of the Parks Division's resources to its programs is shaped not by the MDC Commission's priorities, as required by the McKinsey planning process, but rather by the Parks Division's project choices. The Division Director's preferences govern final project selections, and the Director decides whether and when the division should hire a consultant to study and evaluate the current requirements of a particular program area; when the consultant completes the study and presents the division with a list of project alternatives to address the needs identified in the study, the Division Director selects the project or projects which he regards as most urgent.

Some of the projects which emerge from this selection process may well be legitimate, high-priority projects. However, project selection decisions are not guided by prior long-range planning, policies, priorities, and selection criteria. As a consequence, the Parks Division's project selection process is idiosyncratic, inconsistent, and highly vulnerable to short-term pressures. There appear to be few safeguards against potential abuse of the project selection process by division staff, MDC Commissioners, or other influential groups.

Finding 2b.

Project cost estimates are unreliable

Each project contained in the Parks Division's program plans is summarized on a Work Schedule Form indicating the estimated cost of the project (as well as the project description, staff assignments, and tentative schedule). Accurate project cost estimates are important for several reasons: to ensure that sufficient funds are budgeted and allocated to each project, to serve as a standard against which to evaluate consultants' cost proposals, to provide a basis for controlling requests for contract change orders, and to furnish MDC and the Legislature with a realistic price tag for proposed MDC programs.

Despite these important functions of accurate project cost estimates, MDC Parks Division officials discount their importance. While project engineers are expected to give their "best guesses" in estimating project costs, division officials acknowledge that the accuracy of these guesses varies considerably, depending upon the caliber of the project engineer. When asked how he derives project cost estimates, one experienced project engineer replied, "Out of the air." However, he stated that such estimates are valuable nonetheless, since they "keep the consultant from going haywire." The Director of Project Planning and Management stated that he is not troubled by the inaccuracy of in-house estimates, since these estimates "aren't real," and are used only for "planning purposes." The Division Director expressed a similar viewpoint, arguing that if a consultant is ultimately hired to carry out a project, the cost estimates prepared by division engineers do not matter, since the actual magnitude and cost of the project will not be known until the consultant becomes involved in the project. The Director also pointed out that

the Parks Division lacks the resources necessary to conduct a detailed cost analysis, whereas professional consultants have this capability.

The case studies show that MDC's failure to evaluate the reliability of cost estimates furnished by consultants and contractors has resulted in poor project selection decisions. The General Lawrence Bridge case study (Chapter One) describes the process by which a consultant's project cost estimate of $7.5 million doubled to $15 million over the course of the project. And in the previously-cited Tenean Beach case, MDC accepted the construction contractor's $10,000 cost estimate for a granite wall despite the fact that the next two lowest bidders had estimated the wall's cost at $100,000; the contractor then demanded an additional $95,000, and ultimately failed to complete the project. By failing to evaluate the reasonableness of cost estimates furnished by consultants and contractors, the Parks Division increases the risk that feasible project alternatives will not be examined, and that funds may therefore be appropriated to design projects and construction contracts whose costs are unnecessarily high.

Finding 2c.

Project alternatives are not seriously considered

The McKinsey manual requires project engineers to prepare a four-to ten-page project justification for each project included in the proposed program plans. The project justification is supposed to describe the project's objectives and tasks, analyze and evaluate the costs and benefits of project alternatives, outline a plan for implementing the recommended alternative, and list the tasks required during the implementation plan's first phase. These documents are incorporated into the preliminary and final versions of the program plan that is to be submitted to the Commission for review and approval. In the planning process that McKinsey recommended, the project justification would be an important management tool. It would help division officials evaluate alternative projects and would enable the Commission to evaluate alternative projects recommended by the Parks Division against other feasible alternatives, thereby increasing the Commission's capacity to make informed resource allocation decisions.

In practice, however, the project justification's potential benefits are not realized. Many of the project justifications prepared by Parks Division engineers do not analyze and evaluate the costs and benefits of a range of alternatives to the recommended project. For example, the project justification prepared for a project to reconstruct and upgrade the Lynnway and General Edwards Bridge states:

> "...The Lynnway was last rebuilt in 1955. Its surface is bituminous concrete and is in a deteriorated condition. Due to the amount of trucks and buses that use this roadway, it is recommended that the road be reconstructed rather than resurfaced."

No cost comparisons between the reconstruction and resurfacing options are provided in this project justification. Rather, after noting that the City of Lynn was engaged in a major urban rehabilitation program, the justification concluded:

> "Therefore, the Metropolitan District Commission has an obligation to cooperate with the City of Lynn in their revitalization program by doing their part in upgrading the Lynnway and General Edwards Bridge."

And in a project justification for construction of a team change room addition at a skating rink, the section entitled "Options" simply states:

> "The above is the recommended option; the no-action plan is not in the best interest of the Commission."

Parks Division and Planning Office officials acknowledge that some project justifications are sketchy, and might more accurately be characterized as brief project descriptions.

While some project justifications prepared by division engineers do contain detailed analyses of project alternatives and their estimated costs and benefits, there is little incentive for project engineers to furnish this type of detailed analysis. The Parks Division Director does not use project justifications in choosing the projects he includes in the division's program plan, nor does he include project justifications in the written plan he submits to the Commission each year. Moreover, the Division Director stated that he does not discuss project alternatives

when verbally presenting the division's proposed annual program plan to the Commission. Rather, the Director explained, he describes each project contained in the plan, explains why it was selected, and answers the Commissioners' questions. According to the Division Director, the Commission routinely approves his plan as presented.

MDC's tendency to disregard feasible project alternatives is further illustrated by the Parks Division's practice of combining study and design work in a single consultant contract. According to Parks Division officials, the division typically enters into a single contract with a consultant to both assess alternative approaches to a project, and perform the project's subsequent design work. Implicit in this type of combined study/design contract is the assumption that the project approach that will be selected will involve substantial design work. Yet the feasible alternatives for some types of projects may span a wide range of options from minor repair work to major project design or redesign. By awarding a combined study/design contract to a consultant for such projects, MDC creates a strong incentive for the consultant to recommend the most complex, expensive project approach during the study phase, since this alternative will maximize the consultant's role during the design phase. For example, an objective investigation of a deteriorated bridge might reveal that simple repairs are preferable to, and less costly than, replacement of the bridge. However, if the division had already hired a consultant to both study what should be done and then perform the subsequent design work, the consultant might be less likely to recommend the repair option, and the Parks Division might be less likely to adopt it.

Moreover, MDC does not routinely require consultants who are awarded study/design contracts to submit "bare-bones," or minimal, designs and cost estimates. Without such a policy, MDC cannot distinguish the minimum cost of a structural design from the costs of aesthetic features added to the basic design.

The risk that consultants will benefit financially by recommending unnecessarily costly design alternatives may appear low, since MDC negotiates a maximum price for the final design work. In practice, however, MDC routinely approves project cost overruns, and consultants who incur design costs in excess of their original estimates are rarely penalized.[1]

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[1] Chapter 579 of the Acts of 1980 made feasibility designers of State or County building construction projects ineligible for appointment to perform design services for those projects. This safeguard was intended to prevent a firm which had developed master plans, analyzed feasibility, or produced programs per-

The Parks Division Director does not consider the practice of combining study and design work inappropriate: he maintains that consultants are professionals who can and should be trusted to make unbiased design recommendations. The Director of Project Planning and Management concurs with the Division Director. Both officials also report that MDC is short of both time and staff, and that contracts which combine study and design require less time to administer and oversee than separate study and design contracts would require.

Finding 3.

The Commission Has Abdicated Its Policy-Making Responsibilities

The McKinsey planning manual clearly identifies the MDC Commission's policy-setting functions at each stage of the planning process:

1. The Commission is responsible for final review and approval of the master plan, which defines each division's overall goals, policies, and objectives.

2. The Commission approves program objectives prior to preparation of each division's program plan.

3. The Commission determines the level of resources to be committed to each division, and the allocation of these resources to division programs.

4. The Commission selects project alternatives within each program, based on the project justifications prepared by each division.

5. The Commission approves each division's program plans, work schedules, and budget.

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taining to a public building construction project, and which thereby had influenced the character, scope, or budget of the design contract for that project, from benefiting financially from such influence by being awarded that design contract. Bridges, roadway construction, water and sewer system work, and most other types of "horizontal construction" projects normally carried out by MDC are not subject to this safeguard, however, because such construction projects fall outside the definition of "building projects" to which Chapter 579's requirements apply.

Despite the clarity with which the McKinsey recommendations delineate the Commission's policy-making responsibility, the Commission has systematically failed to exercise that responsibility. One important reason that the Commission does not discharge its policy-setting functions is that it does not obtain the information it would need to discharge these functions; as already noted, master plans have not been updated, and thus have not provided the Commission with a policy framework for evaluating division program plans. The Commission is not given detailed project justifications prior to approving the program plans, and thus cannot evaluate or select projects against alternatives or choose between the alternative policies that alternative projects can pose. By preselecting the projects to be undertaken by the division, and by failing to provide to the Commission a range of feasible program and project alternatives, Parks Division officials ensure that they -- not the Commission -- will effectively set the division's policies and priorities.

The Commission's abdication of its policy-making responsibility gives cause for considerable concern. Because Parks Division officials are free to select projects without reference to prior written criteria and without analysis of project alternatives, resource allocation decisions tend to be unduly influenced by short-term crises, political pressures, and staff preferences. By delegating this key oversight role to the very division-level officials that it should be overseeing, the Commission significantly increases the risk that abuses at the division level will go undetected, and that public funds will be misappropriated and mismanaged.

Recommendations Concerning Project Planning

Very few of McKinsey's substantive recommendations for improving MDC's planning systems have been fully implemented. The serious planning-related problems documented in the case studies therefore seem likely to recur in the future unless MDC makes a concerted effort to strengthen its planning capacity. To initiate that effort, the Inspector General recommends the following actions:

1. In order to minimize project cost overruns and improve MDC's control over expenditures, the Parks Division should improve the reliability of project cost estimates. If necessary, the division should provide training to project engineers in order to upgrade their cost estimating skills. Project cost estimates developed by consultants should be thoroughly reviewed by qualified in-house staff; consultants should be required to document or justify estimates which appear unduly low or high.

2. The MDC Commission should adopt a policy prohibiting combined study/design consultant contracts. By separating these tasks, the Commission will increase the likelihood that all project alternatives, including non-design options, will be investigated and evaluated objectively by the consultant hired to conduct the feasibility study.

3. The MDC Commission should direct its Planning Office and Parks Division officials to implement the master planning system recommended by McKinsey & Company, Inc. Master plans should be reviewed annually and updated as required. The Commission should use the updated master plans as a policy framework to guide and control all division-level planning activities.

4. The MDC Commission should direct the Parks Division to include detailed project justifications in the preliminary program plans it submits to the Commission. Each project justification should relate the project's objectives to the Commission's approved program objectives; analyze the costs and benefits of alternate approaches to the project; and outline a plan for implementing the recommended project approach. After reviewing the project justifications, the Commission should decide which of the available alternatives will be adopted for each project. These decisions should then be incorporated into the final version of the Parks Division's two-year, aggregate plan.

CHAPTER SIX

CONSULTANT SCREENING AND SELECTION

Introduction

All major construction projects undertaken by MDC's Parks Division are designed by private firms under contract to the Commission. As a rule of thumb, the consultant's design fee can range up to ten percent of the project construction cost; thus, the negative impact of a poor consultant selection decision on public expenditures far exceeds the cost of the design contract. Procedures for identifying, evaluating, and choosing consultants should facilitate competition, ensure selection of qualified designers, prevent favoritism, and promote public confidence in the integrity of the contract award process.

The case studies presented earlier (Part I) revealed substantial deficiencies in MDC's procedures for selecting consultants. In the General Lawrence Bridge project (Chapter One), MDC failed to evaluate the qualifications of the consultants considered. In the Tenean Beach project (Chapter Two), methods used to select a consultant were inconsistent and superficial. In the Three Charles River Bridges project (Chapter Three), MDC's selection process employed inappropriate selection criteria and ignored consultants' past performance on MDC projects. These deficiencies in MDC's selection process contributed to design problems and substantially increased project costs.

McKinsey's Recommendations On Consultant Screening And Selection

The 1981 management study of MDC conducted by McKinsey & Company, Inc. recommended that MDC adopt a new consultant selection process. This new process, which was approved by Commission vote in early 1981, incorporated the following elements:

- MDC's Consultant Selection Committee (hereafter, "the Committee"), whose members had previously been chosen by the Chief Engineer, was restructured to include a voting representative from each of the four MDC divisions. The project engineer was to serve as a temporary voting member.
- The position of Contract Administrator was created to negotiate fees and overhead rates with consultants, and to monitor the consultant selection and project management processes;
- Evaluation criteria and forms were developed for use by the Committee in screening and selecting consultants.

The consultant selection process recommended by McKinsey consisted of eight steps:

1. Advertise project for letters of interest.
2. Prepare request for proposals (RFP).
3. Screen firms to receive RFP.
4. Evaluate proposals and select a consultant.
5. Negotiate contract with consultant.
6. Draw up contract.
7. Consultant signs contract.
8. MDC Commission signs contract.

After the Commission approved the McKinsey system, MDC restructured the Consultant Selection Committee and hired a Contract Administrator, who was assigned two assistants. In interviews conducted in early 1983, MDC officials stated that the process outlined in the McKinsey manual is currently followed in selecting consultants for MDC projects.

However, the Inspector General's review of current consultant selection practices indicates that MDC has discarded many of the procedures prescribed by the McKinsey manual, and has in other respects failed to achieve the safeguards that an adequate consultant selection procedure would provide. Significant problems identified in the case studies can therefore be expected to recur, as shown by the findings which follow.

Finding 1.

MDC's Consultant Screening Procedures Inhibit Fair And Open Competition

Finding 1a.

Advertising for consultants did not meet statutory requirements until September 1982

The McKinsey manual outlines a three-step process for screening consultants: 1) MDC advertises for interest in the project, 2) consultants submit letters of interest describing their qualifications for the proposed work, and 3) the Consultant Selection Committee screens the letters of interest and selects at least five qualified consultants to receive copies of the RFP. In September 1982, the Inspector General notified MDC that its current procedures for inviting letters of interest did not fulfill the statutory requirement that State design projects be advertised in the Central Register published by the Secretary of State. In response, MDC began advertising for consultants in the Central Register.

Finding 1b.

Current procedures for evaluating consultant qualifications are unreliable

Each firm responding to MDC's advertisement submits a standard form indicating the firm's experience, key personnel, resources, and other pertinent information. The McKinsey manual contains an Initial Screening Form which each voting Committee member supposedly uses to evaluate the qualifications of consultants submitting information to MDC. This rating form, which is intended to document the screening process, specifies seven evaluation criteria, including project experience, key personnel, and resources of the firm. The form also prescribes the relative weight to be assigned to each criterion.

However, the Committee does not use this rating form (or any other rating form) during the screening process. Instead, the Committee makes consultant selection decisions by voice vote. No record of their evaluations is kept. Although the McKinsey rating form contains written screening criteria, the Contract Administrator and Committee members interviewed reported that they instead use several unwritten screening criteria developed by the Committee. These criteria include the firm's age, location, and amount of other current MDC work. According to the Contract Administrator, a firm which has operated for fewer than five years is not selected by the Committee, since MDC prefers to contract with "tried and true" firms.[1] One Committee member stated that if the Committee receives a large number of letters of interest from firms based in Massachusetts, he eliminates firms located outside Massachusetts from further consideration.[2] All Committee members interviewed stated that the Committee has the responsibility to "spread the work around" by distributing design contracts evenly among the consulting firms regarded by the Committee as qualified.[3]

The above criteria are totally inconsistent with those recommended by McKinsey and adopted by the Commission; they are also arbitrary and inequitable. By eliminating relatively new firms and out-of-state firms, Committee members significantly restrict competition without Commission approval. The unwritten practice of spreading the work around is similarly ill-advised. According to the Committee members interviewed, firms which currently hold a large number of MDC contracts are eliminated during the screening process on the grounds that their staff might be overburdened if the firm were awarded another MDC contract. Clearly, such reasoning is illogical: without knowledge of a firm's commitments to other clients, the Committee cannot accurately assess the workload of that firm's staff. Moreover, if the Committee's screening criteria are partially unrelated to applicants' professional capabilities, the ultimate objective of the screening

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[1] After reviewing the draft version of this report, the Contract Administrator stated that firms are not automatically eliminated if they have operated for fewer than five years.

[2] However, the Contract Administrator stated that the Consultant Selection Committee has awarded contracts to no fewer than eight firms whose home office is out-of-state.

[3] However, the Contract Administrator stated that the Consultant Selection Committee has awarded contracts to no fewer than eight firms with whom MDC had not previously contracted.

process -- to identify the most qualified consultants for the job -- is undermined. In addition, this practice increases the screening process' subjectivity, and therefore, potential for its abuse. A better strategy, which is recommended in the McKinsey manual, would be to evaluate the firm's technical capacity to do the work, withholding judgment regarding the adequacy of its available resources until the firm has submitted a formal RFP containing this information.

Another source of unreliability in the Committee's evaluations of consultants' qualifications stems from the lack of complete information on consultants' past performance on MDC projects. MDC's "Consultant Contract Guidelines," approved in 1978, contained a Consultant Rating Form; however, this form has not been used in recent years. Consequently, documentation of consultants' past performance does not exist. To the extent that Committee members consider past performance in their screening process, they rely on division employees' undocumented recollections. This anecdotal method furnishes no assurance that past problems experienced with consultants will be consistently identified, accurately diagnosed, reported to the Committee, and used to screen out unsuitable applicants.

Recently, MDC's Contract Administrator circulated the 1978 Consultant Rating Form to division directors for comments. However, the form is not yet in use at the division level, and evaluations produced with it are therefore not yet available to the Committee.

Finding 1c.

The low number of firms selected by the screening process appears unjustified

As stated earlier, the Commissions's approved McKinsey manual specifies that the consultant screening process should select at least five qualified firms to be sent copies of the project RFP. In certain cases, however, the Committee -- again without the Commission's approval -- has chosen to reduce the number of firms selected during the screening process. For projects with estimated costs over $100,000, the Committee selects five firms to receive copies of the RFP; for projects with estimated costs between $40,000 and $100,000, only three firms are selected; and for projects with estimated costs under $40,000, the Committee simply selects a firm to do the work, based upon letters of interest received.

The rationale for the above practice is unclear. The Contract Administrator emphasized the importance of time, noting that some projects have crucial deadlines. (Apparently, the Contract Administrator believes these deadlines might be difficult or impossible to meet if the Committee were required to evaluate five rather than fewer proposals.) A member of the Committee stated that five proposals are necessary to furnish an adequate cross-section of project approaches, but argued that Committee members do not have time to thoroughly review five proposals for each project.

Whatever its rationale, there are drawbacks to the practice of using estimated project cost to determine when fewer than five firms may receive copies of the RFP. First, the case studies have furnished ample evidence that initial project cost estimates can be highly inaccurate. For example, the estimated cost of the General Lawrence Bridge project (Chapter One) has more than doubled since the project began; the estimated cost of the Tenean Beach project (Chapter Two) has tripled; and the estimated cost of the George's Island Pipeline (Chapter Four) has increased four-fold. There is no reason to suppose that these examples are isolated cases of poor estimating, since division engineers are not expected to develop accurate cost estimates. The Parks Division Director has stated that if MDC is planning to hire a consultant to design a project, the initial cost estimates are not important.

Second, the Committee's current screening practices reduce competition in the consultant selection process. The alleged reason for reducing competiton -- to save time for Committee members -- does not appear to justify the risk that the range of project approaches obtained may be inadequate, that MDC may incur excessive consultant fees, and that the designs adopted may not satisfactorily serve the Commonwealth's interest.

Finding 2.

MDC's Proposal Selection Process Is Undermined By Arbitrary, Non-Uniform Evaluation Procedures

Once the firms invited to submit proposals have done so, the Committee evaluates them. The McKinsey manual includes a two-page Proposal Evaluation Rating Sheet containing five categories of evaluation criteria and numerical weights to be assigned to each category. The manual gives instructions for assigning numerical values to each evaluation criterion. This uniform, explicit, and quantitative approach to the Committee's evaluations appears designed to promote accountability, reliability, and merit-based assessments of consultants' qualifications.

Despite the potential benefits of the manual's explicit consultant selection system, in practice each Committee member is permitted to decide unilaterally whether to use the Proposal Evaluation Rating Sheet. Furthermore, those who choose to use the rating sheet are permitted to assign whatever weights they feel are appropriate to each evaluation category. Those who choose not to use the sheet are permitted to invent their own proposal selection methods.

The recent selection process for proposed redesign of the General Lawrence Bridge illustrates the idiosyncratic character of MDC's current proposal selection practices. Evaluation forms completed by three of the five voting Committee members were available for the Inspector General's review. (The other two evaluation forms had been thrown away.) One member had used the McKinsey evaluation sheet and weighting system. The second had designed his own form and weighting system, both of which deviated substantially from those prescribed by the McKinsey manual. The third Committee member had merely scribbled notes on two pages of lined paper.

The Committee also deviates from Commission-approved procedures in assessing consultants' qualifications. According to the McKinsey manual, the Committee "is responsible for evaluating and selecting the most qualified consultant." After this selection has been made, the project engineer and the Contract Administrator are responsible for negotiating manhours and fees with the top-ranked firm. If they

are unable to reach agreement with the top-ranked firm, they begin negotiations with the second-ranked firm. This process is repeated with each firm, in order of rank, until an acceptable agreement on contract manhours and fees has been negotiated. It therefore is improper for the Committee to consider costs and manhours in its assessment of consultant qualifications. Nevertheless, interviews with Committee members revealed that they applied these inappropriate criteria in evaluating the General Lawrence Bridge proposals. One member downgraded a proposal which mentioned overtime costs, on the assumption that it would entail higher costs than proposals which did not mention overtime costs. Four members stated that the number of manhours proposed by each firm had influenced their evaluations. These unauthorized deviations from the Commission's approved consultant selection process make it less likely that the most qualified firm will be selected, and thus undermine the integrity of the evaluation process.

All four voting Committee members interviewed asserted that standard evaluation criteria are unnecessary. One member explained that "if three people [on the Consultant Selection Committee] do an honest job, the system will work" regardless of the evaluation method each person uses. This point of view is apparently shared by MDC's Contract Administrator, whose position was created to oversee and enforce the consultant selection process: he does not require Committee members to use standard evaluation categories, weights, or forms.

Finding 3.

Poor Documentation Of MDC's Consultant Selection Procedures And Decisions Diminishes Accountability And Control

Finding 3a.

Current policies and procedures are unclear

The manual prepared by McKinsey constitutes the only documentation of MDC's consultant selection procedures available to Committee members and other interested persons; however, as previous findings have indicated, the Committee has chosen to

change or ignore many of the procedures contained in the manual. The Committee is able to do so because it is not required to document its decisions, and because its decisions are not systematically reviewed.

One reason that the Committee does not document its consultant selection procedures and decisions may be that its members are unsure what those procedures and decisions should entail. In interviews, Committee members appeared confused regarding current policies and procedures. One member complained that the "rules keep changing," and noted that the rules are not written down. For example, MDC has not established written policies governing whether the agency should solicit additional proposals if the number of proposals received is lower than the number solicited. According to the Contract Administrator, such decisions are made on a case-by-case basis. While the absence of consistent, documented MDC policies governing these and other consultant selection decisions certainly enhances the Committee's flexibility, it also reduces MDC's internal control over selection decisions, and exposes the agency to public perceptions of impropriety.

Finding 3b.

Completed proposal evaluation forms are not retained for future use

Although the Contract Administrator files and retains Committee agendas, minutes, and ballots showing the proposal rankings assigned by each Committee member, he does not collect and retain the proposal evaluation forms that the Committee members complete. When problems arise during a project's design or construction, or after its completion, MDC needs access to the completed consultant evaluation forms to determine how and why the project consultant was selected, and how MDC can avoid such problems in the future by altering current consultant selection methods. As the case studies have demonstrated, the consultant's initial design proposal can significantly affect a construction project's ultimate cost and workability. Without documentation of how consultants' proposals are evaluated, effective management and public oversight of the consultant selection process becomes nearly impossible.

Nevertheless, the Contract Administrator is opposed to collecting and retaining the consultant evaluation forms, although he does encourage Committee members to

keep their own evaluation records. He has expressed concern that the practice of maintaining a central file of evaluation forms would result in the formation of "coalitions" among Committee members, and would hamper "individualism" to the detriment of the evaluation process. One Committee member offered another argument against documenting the evaluation process: "Why open it up to criticism?"

Finding 4.

MDC Staff Have Both Established And Changed Consultant Selection Policies Without Commission Approval

As the previous discussion has illustrated, MDC's current consultant selection procedures often bear little or no resemblance to the McKinsey manual's procedures adopted by the Commission two years ago. In some cases, the procedural changes adopted by the Consultant Selection Committee have in effect caused major policy shifts which have never been voted on or approved by the MDC Commission. For example, the previous three findings have shown that, contrary to the Commission-approved procedures contained in the manual:

- the Committee has discarded the manual's consultant screening criteria and form in favor of an entirely different set of unwritten criteria;
- the Committee has reduced the specified minimum number of firms receiving copies of the RFP for projects; and
- Committee members are permitted to evaluate proposals using whatever criteria, weighting techniques, or forms they prefer.

Committee members thus have substantial opportunity to impose their values and preferences on the selection process. For example, the Commission-approved proposal evaluation process requires that the equal employment opportunity compliance category be assigned a weight of 20 percent. One Committee member

stated that although he knew this to be official Commission policy, he did not feel that MDC should be running a social program, and therefore chose to assign this category a weight of five percent.

Recommendations Concerning Consultant Screening And Selection

It would appear that the MDC Commission has lost or relinquished control over the consultant selection process. Only by regaining control -- by establishing and enforcing consistent policies and standards -- can the Commission satisfy itself and assure the public that decisions rendered by the Consultant Selection Committee reflect the Commission's values, serve the Commonwealth's interests, and minimize the risk of favoritism and abuse. In order to achieve these important objectives, the Inspector General makes the following recommendations:

1. The MDC Commission should instruct the Consultant Selection Committee to consider consultants' past performance. The Consultant Rating Form currently in draft form should be finalized and used. The Contract Administrator should ensure that all divisions submit Consultant Rating Forms for each completed design project. In screening consultants submitting letters of interest, the Committee should review the completed Consultant Rating Forms and check each consultant's references. Consultants who have performed poorly on past MDC or non-MDC projects should be disqualified. Exceptions to this procedure should require Commission approval.

2. The MDC Commission should formally approve and document in writing all MDC policies and procedures governing the consultant selection process. These policies should address, but not be limited to, the screening and selection criteria to be applied by the Consultant Selection Committee and the minimum number of consultant proposals to be solicited by the Committee. Any policy change desired by the Contract Administrator and the Consultant Selection Committee should be proposed in writing, and voted on and approved by the MDC Commission before the Committee adopts it.

3. MDC's Contract Administrator should enforce the Commission's written consultant screening and proposal selection procedures, including evaluation criteria and rating forms. The consultant screening and proposal selection

procedures and forms designed for MDC by McKinsey have already been adopted by the Commission; should the Commission choose to retain them in their present form, the Contract Administrator should immediately train the Committee members in their use and oversee their implementation.

4. MDC's Contract Administrator should maintain a central file of consultant screening and proposal evaluation forms completed by Consultant Selection Committee members. Prior to each contract award, the Contract Administrator should review all completed forms to ensure that Committee members used proper evaluation criteria and numerical weights to rank consultants under consideration. Thereafter, the Contract Administrator and his staff should periodically assess the effectiveness of MDC's consultant screening and proposal selection procedures. For example, the Committee's initial evaluation forms should be re-examined for all consultant firms which subsequently receive poor performance evaluations of their work from MDC engineers.

5. The MDC Commission should instruct the Contract Administrator to update the consultant selection manual as necessary. The manual should clearly state all Commission-approved policies and procedures governing the consultant selection process. Copies of the updated manual should be distributed to all Consultant Selection Committee members and MDC Commissioners.

CHAPTER SEVEN

CONTRACTOR PREQUALIFICATION AND SELECTION

Introduction

The process of prequalifying and evaluating prospective contractors is intended to ensure the technical competence and financial capacity of the private construction firms who build MDC's projects. Massachusetts General Laws Chapter 29, section 8B requires that contractors who wish to bid on MDC-administered construction contracts totalling $50,000 or more first be prequalified. To become prequalified to bid, a contractor must submit a prequalification statement which includes detailed information regarding the firm's experience, financial condition, and staff capability to MDC's Prequalification Office. A part-time consultant to MDC, who is a certified public accountant, reviews the financial information contained in the prequalification statement, and recommends a "maximum capacity rating" for the contractor. This rating represents the total dollar value of the work the firm may have under contract at any time. The size of the MDC contract on which the firm may bid is determined by subtracting the dollar value of the firm's work in progress from the firm's maximum capacity rating.

The Prequalification Office forwards the prequalification statement and the consultant's recommendation to MDC's Prequalification Committee for review. This committee consists of four members appointed by the Contract Administrator; the Contract Administrator serves as chairman. When 13 or more prequalification statements have been received by the Prequalification Office, the Contract Administrator convenes the Committee, which then reviews the submitted materials, approves the recommended maximum capacity ratings, and decides by majority vote on the categories of work each contractor will be prequalified to perform for MDC. Contractors are notified by mail of the Committee's decision. Prequalification ratings remain in effect for 16 months following the date of the financial statement submitted by the contractor. Contractors may appeal the Committee's decisions to the MDC's Prequalification Appeal Board.

The Inspector General's review of MDC's current prequalification process identified three major weaknesses which are discussed in the following section.[1]

[1] The McKinsey study did not address MDC's contractor prequalification and selection procedures.

Finding 1.

MDC Prequalifies And Accepts Bids From Contractors Who Have Performed Unsatisfactorily In The Past

MDC is authorized by statute to consider contractors' past performance in determining their eligibility for prequalification. Massachusetts General Laws Chapter 29, section 8B states:

> "The information contained within such [a prequalification] statement, together with other relevant available information and the proposed bidder's past performance on work of a similar nature, may be considered by said...Commission in determining whether or not the proposed bidder is qualified to perform any specific work for which proposals are to be invited."

Accordingly, MDC regulations governing prequalification permit MDC to reduce a contractor's maximum capacity rating via "deductions" for unsatisfactory past performance.

Nevertheless, the Prequalification Committee does not systematically review contractors' past performance prior to assigning maximum capacity ratings or determining which categories of work contractors will be prequalified to perform. Although each contractor's prequalification statement lists major projects completed and clients served within the last five years, the Prequalification Committee does not contact these clients to obtain references. Moreover, although contractor evaluation forms are regularly completed by MDC engineers and filed in the Prequalification Office, the Prequalification Committee does not review these forms prior to prequalifying contractors with whom MDC has contracted in the past. According to the Contract Administrator, the Prequalification Committee members usually know the reputations of contractors seeking prequalification. However, even if the Committee is aware that a contractor has performed unsatisfactorily in the past, the Committee does not use the capacity deductions permitted by MDC's prequalification regulations: according to the Contract Administrator, reducing a contractor's maximum capacity rating is "very awkward." Thus, a firm with a

history of poor project management and deficient work is likely to be prequalified by the Committee if the firm's financial capability is deemed adequate by the MDC consultant responsible for reviewing the firm's financial statement.

After the bids on a contract have been opened and an apparent low bidder has been identified, the project engineer is responsible for checking the bid and for reviewing the contractor's past performance by contacting the firm's references; however, MDC does not reject bids upon learning of a contractor's unsatisfactory past performance. The Contract Administrator has stated, "I don't believe you can deny a contractor a job just because he didn't manage a contract well." Instead of rejecting the low bidder whose past performance appears unsatisfactory, the Contract Administrator notifies the MDC Commission of the results of the reference check, so that the contractor can be "dressed down" at the bid award or preconstruction meeting. Moreover, MDC has never sought to debar a contractor, according to the Contract Administrator. He explained that to do so, MDC would have to make a recommendation regarding debarment to the Department of Labor and Industries, which would require "a lot of back-up data and hard facts." MDC's failure to deny prequalification status, reject bids, or debar contractors in response to poor contractor performance increases the likelihood that these same contractors will contribute to future project delays, cost overruns, and other problems.[2]

Finding 2.

MDC Lacks Clear, Comprehensive Prequalification Standards

As noted in the introduction to this chapter, the Consultant Selection Committee decides by majority vote which classes of work contractors will be

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[2] The Contract Administrator did, however, cite two instances in which MDC revoked or threatened to revoke prequalification in response to a contractor's poor performance on an ongoing MDC project. In one case, the Contract Administrator revoked a contractor's prequalification in one work category until he proved that he could do the work; in the other case, the Contract Administrator instructed the Construction Supervisor to warn a contractor in writing that his prequalification would be revoked unless his progress and performance improved.

prequalified to perform. According to the Contract Administrator, the Committee makes the determination by reviewing, for each contractor, the classes requested by the contractor, and the type and amount of work the contractor has handled in the past. However, the basis upon which the Committee members decide whether or not the contractor should be prequalified for a given class is unclear, since written guidelines do not exist. Committee members are apparently free to decide for themselves the type and amount of experience required to be prequalified in each class. Moreover, the classes of work considered by the Committee are general in nature -- for example, "general highway construction," "maintenance," and "waterways" -- and do not include the highly specialized methods which MDC occasionally requires of contractors. MDC therefore lacks control over this critical prequalification process: the Commission has no assurance that the classes of work and the standards employed by the Committee members are sufficient to protect the agency from construction problems stemming from contractor inexperience.

Finding 3.

MDC's Prequalification Process Lacks Conflict Of Interest Safeguards

As noted in the introduction to this section, MDC relies on a part-time consultant, who is a certified public accountant, to assess the financial capability of firms applying for prequalification status. MDC does not require this consultant to submit a list of his private clients who might be affected by MDC's prequalification decisions. More generally, according to MDC's Prequalification Officer, no one at MDC checks or reviews the consultant's work or decisions. Thus, MDC is incapable of determining: 1) whether any of the consultant's clients have a financial interest in MDC's prequalification decisions, and 2) whether the consultant's recommendations to the Prequalification Committee are reasoned, unbiased, and consistent.

The Inspector General's review did not attempt to determine whether a conflict of interest actually exists in this situation; the point stressed here is that

MDC currently has no controls over the critically important contractor screening and capacity rating decisions that its part-time consultant makes.

Recommendations Concerning Contractor Prequalification And Selection

MDC's current contractor prequalification and selection system fails to realize its purpose: to ensure that contractors awarded MDC construction projects will have the technical competence, financial capacity, and administrative systems required to complete construction in accordance with contract plans, specifications, and timetables. In order to correct this deficiency, the Inspector General recommends the following:

1. MDC's Prequalification Committee should consider past performance in prequalifying contractors. The Committee should review the completed contractor evaluation forms on file in the Prequalification Office, and should check outside references. The Committee should, in accordance with MDC regulations, reduce the contractor's maximum capacity rating by means of deductions for unsatisfactory performance on projects within the past five years. In addition, the Committee should use evidence of unsatisfactory performance as a basis for excluding the contractor from certain categories of work and, where appropriate, denying the contractor prequalification status.

2. The MDC Commission should reject low bids from contractors whose past performance has been unsatisfactory. The Contract Administrator should establish and enforce a consistent procedure for checking references of low bidders. This procedure should supplement, not duplicate, the reference checks conducted by the Prequalification Committee; all contractor references not checked during the prequalification process should be contacted prior to the contract award. The Contract Administrator should recommend to the MDC Commission that the bids and contractors whose reference checks reveal unsatisfactory past performance on past projects be rejected; upon determining that the Contract Administrator's recommendations are properly documented, the Commission should reject such bids, regardless of whether the projects in question were MDC projects or projects for other agencies or clients.

3. MDC should establish and enforce written prequalification standards for all types of work performed by contractors. The Prequalification Committee should use these standards to determine the class or classes of work for which each contractor should be prequalified. In the event that bids are solicited for a highly specialized project not covered by the prequalification standards, MDC should establish minimum experience requirements for the project and reject all bids from contractors who fail to meet these requirements.

4. MDC should require that any consultant who may influence prequalification results submit to the Contract Administrator a list of all current private clients having a potential financial interest, however indirect, in MDC's prequalification decisions. Furthermore, the consultant should be required to notify the Contract Administrator of all prequalification applications submitted to MDC by recent (within the past three years) or current clients of the consultant. Responsibility for analyzing the financial information contained in these applications should be assigned to a qualified MDC staff member designated by the Contract Administrator. This staff member should also conduct periodic reviews of the consultant's work to ensure that the consultant's recommendations to the Prequalification Committee appear consistent and appropriate.

CHAPTER EIGHT

PROJECT MANAGEMENT

Introduction

In the contracted design and construction projects that the Parks Division typically undertakes, organized project management is essential to achieving desired results within established time schedules and budgets. Effective project management systems assign ultimate responsibility for each project's direction and control to a single qualified individual who has the time and commands the resources needed to discharge that responsibility. Effective project management systems also require management controls which are properly designed and faithfully implemented. These controls must identify and report emerging problems before they have caused schedule slippage, cost overruns, or substandard project results.

Like agency-wide planning, project management was a major focus of the McKinsey study. The project management report produced by the study recommended that MDC adopt and enforce extensive new management procedures at every level of the agency to ensure sufficient MDC control over the costs, schedules, and quality of contracted projects.

Project management controls were found to be systematically weak or virtually absent in all the MDC projects described in the case studies. In the General Lawrence Bridge case (Chapter One), MDC's failure to properly control the design work contributed to schedule delays of more than seven years and the waste of nearly $4 million in public funds. In the Tenean Beach case (Chapter Two), MDC was responsible for lengthy delays in approving the contractor's submittals. MDC's failure to ensure adequate inspections during the Three Charles River Bridges project (Chapter Three) caused MDC to seriously underestimate the extent of repair work required on the three bridges. And the George's Island Pipeline case (Chapter Four) contains a series of examples of MDC's mismanagement of the contract, including approval of questionable work methods, payments to the contractor for work which had not been performed, and payments in violation of the contract provisions. Since some of the above examples took place prior to implementation of McKinsey's recommendations, the question arises as to whether implementation of McKinsey's recommendations has remedied any of the considerable

deficiencies documented in the case studies. This question is addressed in the following section.

McKinsey's Recommendations On Project Management

McKinsey recommended that MDC center its project management system around the "project engineer." Under McKinsey's system, the project engineer would have ultimate responsibility for the quality and timing of a project from its initial design phase through completion of construction. In addition to serving as the primary quality control manager, the project engineer would evaluate and approve interim products delivered by the consultant, approve invoices for payment, and report to division management on schedule delays, cost overruns, and other project-related problems. In addition, a "resident engineer" would monitor the contractor's construction work on site, and would keep the project engineer informed of progress.

McKinsey & Company translated their study recommendations on MDC project management into a project management manual, as part of the services for which MDC paid the firm a $200,000 study implementation fee. The manual contains forms and describes procedures to be used to:

- monitor and report on consultant and contractor performance against contract milestones;
- review and approve invoices submitted by consultants and contractors;
- track project costs and progress against budgets for cost and time;
- report problems to managers who can remedy them; and
- perform a final review of the entire project to identify opportunities for improvements in future projects.

Once again, as in the case of McKinsey's planning system recommendations, appearances would suggest that MDC has implemented McKinsey's project management system; project engineers have been assigned to projects and McKinsey's forms, tracking tools, and manuals are all in evidence. However, the Inspector General's review of MDC's actual current project management procedures, reported in the

following section, demonstrates that MDC has adopted only the appearance, not the substance, of McKinsey's project management recommendations.

Finding 1.

The Parks Division's Current Project Management Practices Impede Control Of Design And Construction Contracts

Finding 1a.

Milestone monitoring is unsystematic and incomplete

The McKinsey project management system anticipates that the Parks Division's 24 project engineers will control design and construction contracts by monitoring them against milestones which are to be built into the contract. Each milestone would have a schedule and a product, such as a set of preliminary drawings. The McKinsey project management manual contains a Milestone Monitoring Form which is to be completed by the project engineer after reviewing each milestone product. The form requires the project engineer to describe and critique the product or products submitted, and to explain any actions required by MDC. According to the McKinsey manual, the completed form is reviewed and signed by all project participants, including the resident engineer, a representative from the Reservations and Recreation section (which handles operations and maintenance), the Director of Project Planning and Management, and the Parks Division Director. The Contract Administrator receives copies of the form, which he is to use in monitoring the progress of all MDC projects.

The systematic monitoring of milestones prescribed by the McKinsey manual bears little resemblance to the actual practices observed in the Parks Division's projects. Although the division has incorporated milestones into some recent contracts, it has established no procedures for reviewing and reporting on the deliverables submitted by consultants at contract milestones, or for reporting on the quality of the construction work performed by the contractor. Moreover, the Milestone Monitoring Form designed by McKinsey for these purposes is not used by the Parks Division. Division managers cited a variety of reasons for not using this prescribed form: one manager stated that many projects last only a year or less, and therefore do not warrant milestone reviews; another cited the lack of time

available to project managers for such paperwork; and a third stated simply that the division had not completed implementation of the McKinsey system.

Apparently, then, project engineers are free to decide for themselves how and even whether they will oversee the contracts for which they are responsible, for they do not report on consultant or contractor performance to division management or to the Contract Administrator at the scheduled milestones. The George's Island Pipeline repair project (Chapter Four), which began after the McKinsey system was implemented, illustrates the Parks Division's approach to milestone monitoring. Although the contract specified six milestones, and although the contractor was unable to successfully complete the tasks required by the second milestone, MDC failed to terminate the contract. Instead, MDC staff instructed the contractor to perform a series of additional tasks which were beyond the scope of the contract and which had not been authorized by the MDC Commission. Thus, MDC's top management is incapable of monitoring either the quality of contract work in progress or the adequacy of whatever review procedures project engineers employ. This pattern of weak oversight at all levels of MDC has contributed to and perpetuated serious deficiencies in the agency's projects, as all the case studies have shown.

Finding 1b.

Invoice approval is mechanical, unguided by policy, and unconnected to contract monitoring

The McKinsey project management system requires each project engineer to review the consultant's work against contractual requirements before approving invoices for payment. However, as in the case of milestone reporting, Parks Division management does not recognize the need for exercising control over payments for contract work performed by consultants. Consequently, the invoice approval procedures prescribed by McKinsey have not been implemented.

In the Contract Administrator's view, a project engineer's signature on an invoice establishes that services listed on that invoice have been delivered satisfactorily. Thus, if the project engineer has signed an invoice, MDC pays it.

Notwithstanding the importance attached to the project engineer's signature, division management does not expect or direct the project engineer to check the consultant's work. Moreover, management has established no clear policies governing just how project engineers are to review and approve invoices.

According to the Contract Administrator and the Parks Division Director, project engineers approve invoices by checking the services listed against those contained in the contract; if the billed services are among those called for by the contract, the invoice is approved. The Director believes that there is no need for the project engineers to actually check consultants' work, because consulting firms are "professional outfits."

The Contract Administrator states that the project engineer is not responsible for checking the mathematics of the costs listed on the invoice, since the mathematics are checked by the Contract Administrator's staff, and again by MDC's Finance Office. Nevertheless, one project engineer described his method of invoice approval as follows: he compares the titles and pay rates listed in the invoice with those contained in the contract, he checks all the financial computations, and he signs the invoice. Thus it appears that MDC is devoting substantial staff time to checking and rechecking invoice arithmetic, while ignoring the larger issue of whether the services listed in the invoice have in fact been delivered satisfactorily -- or indeed whether they have been delivered at all.

Finding 1c.

Projects are not systematically tracked and controlled

The project management manual prepared for MDC by McKinsey specifies two project tracking tools. The first, a Work Schedule Form, graphically charts planned versus actual schedules and costs at each contract milestone for all projects assigned to each engineer. This tool has several valuable applications, including early detection of project schedule slippage, forecasts of future cost overruns and project delays, and evaluation of project engineers' management performance. MDC requires project engineers to update the Work Schedule Forms for all projects experiencing delays or cost overruns, and to submit these forms to division

management on a monthly basis. Division managers send the forms to the Contract Administrator, who routes them to the MDC Commission.

Although Work Schedule Forms are being completed, submitted, and processed, they are not being used as they were intended to be used -- to strengthen management control. The cost and schedule information on the Work Schedule Forms is not aggregated by the Contract Administrator's office for purposes of analysis or forecasting. Thus, MDC does not systematically track such key management information as the total dollar value of project overruns within the divisions, cost overruns and schedule delays anticipated in future months, or sources of budget and schedule deviations.

The second project tracking tool described in the McKinsey manual is a wall-sized chart showing the status of all projects with consultant costs exceeding $250,000 or construction costs exceeding $1 million. The manual anticipates that the Contract Administrator will use this chart to track the Commission's highest-cost projects; the chart is also expected to motivate project engineers to manage the charted projects efficiently. The wall-sized chart has been mounted; however, it is not being maintained or updated, and is therefore not useful for tracking purposes. The Contract Administrator acknowledged the chart's value, but said he lacked the staff needed to use it.

Finding 1d.

Exception reporting is not uniform

The project management system designed by McKinsey also employs a Project Management Exception Report which furnishes detailed information regarding projects which are delayed more than two weeks beyond the most recent schedule, and projects with cost overruns greater than five percent of the total contract amount. The Parks Division relies exclusively on this exception report for monitoring purposes. Every month, each project engineer is required to submit a report to the Director of Project Planning and Management. This report lists all of their assigned projects and indicates those which are on schedule and those which deviate from the work schedule. No reference is made to cost overruns. For each delayed project, the project engineer is required to complete and submit a Project

Mangagement Exception Report (along with the updated Work Schedule Form) to the Director of Project Planning and Management. He then forwards these documents to the Contract Administrator, who submits them to the MDC Commission.

Notwithstanding the fact that the exception report is virtually the sole source of detailed project information reviewed by MDC management and the Commission, MDC staff disagree about how the document is supposed to be prepared. The Contract Administrator, who reviews all exception reports, stated that project engineers complete the reports for all projects delayed more than two weeks and for construction projects with cost overruns. In contrast, the Parks Division Director stated that project engineers simply complete the exception reports if time schedules are not being met. A third interpretation was voiced by a project engineer, who stated that he completes all exception reports only for projects delayed more than one month. Given the division's reliance on this report, a clear, uniform policy regarding its preparation is essential. Such a policy either is lacking or has not been successfully communicated to all levels of the organization.

Finding 2.

The Parks Division's Project Management Practices Impede Evaluation Of Consultants, Contractors, And Division Employees

Finding 2a.

Project evaluation procedures are uncoordinated and insufficiently documented

The Parks Division currently does not conduct systematic performance evaluations of its engineering consultants. Thus, prospective consultants are evaluated and selected without benefit of documentation regarding their prior performance on division projects. (See Chapter Six, Consultant Screening and Selection.) The Contract Administrator has drafted a Consultant Rating Form, to be completed by the project engineer, consisting of ten detailed questions regarding

the consultant's performance during the contract period. The form has been circulated for comments, but is not yet in use.

The Parks Division does evaluate the performance of construction contractors. When a construction project has been completed, the resident engineer on the project completes a Contractor Performance Evaluation Report Form ranking the contractor's performance on a five-point scale in seven areas, including quality of work, schedule compliance, and management effectiveness. These forms are submitted to the Contract Administrator.

In addition, the Parks Division requires that each completed construction project be examined by a Final Review Committee consisting of three division engineers selected by the chief resident engineer. According to the Director of Project Planning and Management, this committee reviews each completed construction project and prepares a brief report stating whether or not the final product is acceptable. Upon Committee approval of the contractor's work, the Parks Division authorizes final payment and releases the retainage held on the contract. The Committee's reports are submitted to division management.

The information contained in the Committee's reports is likely to be useful to MDC's Contract Administrator, who is responsible for monitoring the status of all Commission projects. A coordinated procedure, whereby copies of the reports are forwarded to the Contract Administrator, would therefore seem appropriate. However, the Contract Administrator states he is unfamiliar with the Committee review procedure established by the Parks Division, and does not receive copies of the Committee's reports.

According to the McKinsey manual, the final step in the project management process should be a final written review of the entire project, documenting everything of consequence that occurred and suggesting future improvements; the project engineer should prepare the review and the resident engineer and a representative from the operations and maintenance areas should add their comments and sign the review.

The Parks Division has not required its project engineers to prepare this prescribed written review. As a result, the project engineers' knowledge of problems experienced during the project is not documented or used subsequently for planning or evaluating MDC's consultants and contractors. The Parks Division Director regards this required review as superfluous, because in his view the

division will already be aware of problems that occur during a project. However, the Contract Administrator acknowledged that "we don't have a hedge against the loss of information" in the event that a project engineer leaves MDC or retires.

Finding 2b.

Files used for project oversight are poorly organized and incomplete

The Parks Division maintains two separate sets of project files. One set, located in the Parks Division Director's office, contains copies of all project documents, including contracts, invoices, change orders, exception reports, and correspondence. According to the Director of Project Planning and Management, all such project documents are sent directly to the Division Director, who then routes them to other division managers.

The second set of files, maintained by the division's Project Planning and Management section, contains copies of monthly reports, exception reports, and work schedule forms submitted to division management by project engineers. Theoretically, these documents are used by the Project Planning and Management section to monitor the status of ongoing projects and to assess the performance of the project engineers who manage the division's projects.

The project tracking files maintained by the Project Planning and Management section are not very useful for oversight, however, because all project documents are filed together chronologically rather than by project. As a result, one cannot readily review the history of an individual project without sorting through every monthly file and extracting the relevant documents. Moreover, the files are disorderly and incomplete. The Inspector General's review of files pertaining to several current projects repeatedly revealed missing reports, misfiled documents, and incomplete entries on Project Management Exception Reports. For example, the June 1982 Project Management Exception Report for the George's Island Pipeline repair project (Chapter Four) does not indicate the number of days the project was behind schedule, although the report requires this information. Moreover, the report fails to note that the most recent contract extension had expired a month earlier.

In some cases, the completed exception report indicates the project delay or cost overrun, but neglects to explain and describe the corrective actions planned. For example, the Project Management Exception Report dated September 30, 1982 for the Three Charles River Bridges project indicates a cost overrun of $81,750. The project engineer's written responses to the two questions on the form are as follows:

What went wrong?

> "Item Nos. 1 (Crack repair), 11 (Bituminous Base) and 37 (Concrete Base) will overrun."

What corrective action is planned? (Describe actions and dates agreed upon and present status.)

> "I am preparing a commission report with explanations and recommended actions."

The project engineer's entries do not explain either the overrun or the recommended action, nor does the file contain a copy of the Commission report mentioned by the project engineer. Without this information, the file is virtually useless as a record of the project. The Director of Project Planning and Management acknowledges the poor condition of the project files, and cites a lack of clerical staff as the main obstacle to proper maintenance of the filing system. He stated that the division currently assigns two engineering employees to work overtime filing project documents.

Under the current system, an improved filing system would offer no real benefits to the Project Planning and Management section. However, should the Parks Division install a project management system which enables division managers to monitor and evaluate the work performed by consultants, contractors, and MDC project engineers, it will be important to allocate sufficient clerical resources to the task of organizing and updating a thorough, accurate, accessible set of project files within the Project Planning and Management section.

Finding 3.

The Parks Division's Current Project Review Procedures Do Not Ensure That Operating And Construction Problems Will Be Identified And Corrected

A key element of the project management system designed by McKinsey is the participation of operations and maintenance personnel in decisions concerning project design and construction. This participation is meant to ensure that operating needs and concerns are factored into the consultant's design work, and that possible operating problems are addressed during construction. For each project, according to the procedures prescribed by McKinsey, a representative from operations and maintenance would: review the project scope, review and approve consultant products from the 50 percent milestone through project completion, review and approve construction work from the 75 percent milestone through completion of construction, and submit comments for inclusion in a summary memorandum prepared by the project engineer.

The McKinsey manual also specifies a procedure whereby the project's resident engineer, in conjunction with the project engineer, reviews consultant submittals and signs the Milestone Monitoring Forms starting at the 50 percent milestone and continuing through completion of the design work. The purpose of this procedure is to identify and prevent possible construction problems prior to the construction phase.

According to the Director of Reservations and Recreation, to whom the operations and maintenance personnel report, his staff participates only in the initial review of a project's scope; they have no further formal involvement in the project management process. Thus, they do not review the final design contract, nor do they sign off on design or construction work either during or after completion. Both the Director of the Parks Division and the Contract Administrator questioned the value of having the operations and maintenance staff participate, asserting that they might not be able to interpret plans and specifications. However, the Director of Reservations and Recreation supports the formal sign-off procedure outlined in the McKinsey project management manual on the grounds that

the practical knowledge of the operations staff is as critical to a project's ultimate success as the technical expertise of the project engineer.

With respect to the resident engineer's participation in the design review process, the Director of Project Planning and Management states that participation would be desirable, but time constraints sometimes prevent it. The Parks Division Director states that the resident engineer's involvement generally does not begin until the consultant's plans and specifications are 99 percent complete, since the resident engineer needs a "complete package" in order to determine whether construction problems will arise. When asked how this procedure would ensure that consultants did not get "off the track," the Director replied that he did not think consultants were ever off the track.

Finding 4.

Staff Resistance Obstructs Effective Project Management

For the most part, the procedures implemented by MDC in response to the McKinsey study have increased paperwork for project engineers, who are required to complete monthly exception reports and update work schedules for all their assigned projects. According to the Director of Project Planning and Management for the Parks Division, the engineers "would rather be doing engineering than paperwork," and frequently do not submit their reports on time. A review of the division files corroborates this statement: a number of memoranda addressed to the Contract Administrator from division management allude to the failure of certain project engineers to submit required reports on time. Furthermore, the project files contain a number of reports which lack basic information regarding the status of the project budget and schedule.

According to the Contract Administrator, four or five of the division's 24 project engineers regularly "buck the system," and many more "just flat don't believe in this." One project engineer stated that he opposed exception reports and other required forms because the paperwork consumes 30 percent of his time, and because, in his view, the exception reports are not used by management for any

discernible purpose other than to revise project schedules. He argued that project engineers should be evaluated solely on the basis of whether or not they "get [their] assigned jobs out," and that they should therefore have the authority to approve cost overruns and schedule delays if they have reason to believe that the excess funds or time will be "made up" during the next phase of the project.

In view of management's confusion regarding the use of the reports completed by project engineers, it is hardly surprising that those who prepare these reports are unenthusiastic about their use and unconvinced of their value. If the reporting system is to generate valuable project information, the division's managers and project engineers must share a clear understanding of the purpose and use of each required form.

The ability of division managers and the Contract Administrator to enforce these procedures is considerably weakened by an absence of sanctions for non-compliance. MDC has not had a formal system of performance appraisal since 1981; thus, managers cannot use the review process to motivate employees to obey reporting requirements.

Even if regular performance reviews were conducted, it seems unlikely that division managers would penalize offenders. One manager stated that, given the shortage of qualified staff and the difficulty of obtaining funding for additional positions, he certainly would not fire or even demote a competent engineer for failure to submit the required paperwork. The Contract Administrator expressed a similar point of view, arguing that disciplinary measures would only reduce productivity. Introducing new procedures, the Planning Director agreed, required "cajoling" the engineers "a baby step at a time."

In Chapter Ten of this report, the Inspector General has recommended reinstitution of performance appraisals throughout MDC. Unless adherence to the division's management procedures is tied to performance appraisals, however, the reporting problems currently in evidence are likely to continue.

Finding 5.

Uneven Workload Assignments Reduce The Parks Division's Already Limited Capacity For Effective Project Management

According to the Director of Project Planning and Management, the project engineers in his section manage a total of 145 active projects. The Director states that because of the low number of staff relative to the workload, it is often necessary to assign "unqualified" people to the project engineer role.[1] The Parks Division has not specified a minimum grade level for the project engineer assignment; however, the Director of Project Planning and Management cited the position of Junior Civil Engineer as the lowest position to which projects tend to be assigned. It is noteworthy that the official job specification for this position describes the Junior Civil Engineer's work as having "limited latitude for independent or unreviewed action or decision..." and states that the incumbent "works under the supervision of a civil engineer of a higher grade, who gives instructions and checks the work for effectiveness and accuracy." Certainly the demanding official duties of a project engineer require a level of ability far higher than that implied by the specification excerpted above. However, the reportedly unqualified project engineers referred to above are not confined to junior slots: some have been promoted into relatively senior engineering positions within the Parks Division.

To minimize the potential risks associated with assigning project management responsibilities to unqualified or underqualified staff, the Parks Division assigns a disproportionate share of such responsibilities to those engineers perceived by management to be the most competent. An analysis of project assignments listed in the Parks Division's fiscal year 1982 and fiscal year 1983 Program, dated March 1982, illustrates the wide disparities in the number and total dollar value of the projects assigned to engineers with identical titles. Figure E compares the project

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[1] Recommendations for remedying the shortage of qualified engineering staff in the Parks Division are presented in detail in Chapter Ten, Personnel Management.

Figure E

Comparison Of Project Assignments

Title	Number of Assigned Projects	Total Estimated Value of Assigned Projects
ASSISTANT CIVIL ENGINEER (Grade 19)		
A	2	$ 54,000
B	1	$ 400,000
C	1	$ 2,466,869
SENIOR CIVIL ENGINEER (Grade 21)		
A	1	$ 317,000
B	3	$ 593,115
C	11	$37,386,317
PRINCIPAL CIVIL ENGINEER (Grade 23)		
A	9	$ 3,343,354
B	12	$10,707.906
C*	4	$28,671,993

*Principal Sanitary Engineer

Source: MDC Parks Division fiscal year 1982 and fiscal year 1983 Program, March 1982.

assignments of three engineers at each of three grade levels within the division.

While all nine engineers have other duties in addition to the project responsibilities listed in Figure E, the workload distribution shown in the figure is representative of the engineers' total workload distribution, according to the Director of Project Planning and Management. Clearly, no attempt is made to distribute workloads evenly. While "nobody is sitting around," in the words of the Director of Project Planning and Management, the most capable engineers are the most overextended. Under these circumstances, the division's capacity to manage projects effectively appears to be severely limited.

The Parks Division's managers acknowledge the drawbacks of their workload distribution methods; their proposed solution is to add qualified engineers to the division's staff. The Division Director estimates that 20 more engineers, ranging in position from Junior Civil Engineer to Senior Civil Engineer, are needed to properly staff the division.

Recommendations Concerning Project Management

Many serious problems documented in the case studies occurred, it seems clear, because an effective project management system was not in place. Today -- two years after completion of McKinsey's half-million dollar management consulting contract with MDC -- an effective project management system is still not in place. The cost overruns, delays, and poor design and construction documented in the case studies therefore seem likely to recur in MDC's future projects. To prevent their recurrence, the Inspector General makes the following recommendations:

1. The MDC Commissioner should create an Independent Audit Unit to monitor MDC's project management system. Under MDC's current project management system, no independent review of projects occurs. The system relies almost exclusively on the project engineer to provide accurate information on a project's status and problems; as noted above, this needed information often is not transmitted. Given the large number and high total dollar value of projects MDC undertakes each year, and given the poor results documented in the case studies, and evident or alleged in other recent MDC projects, an independent group to selectively monitor, evaluate, and report on the progress of particularly significant projects is essential. Members of this unit should have no direct operational responsibilities within MDC's divisions. (Chapter Eleven of this report describes the composition and functions of the Independent Audit Unit in greater detail.)

   McKinsey recommended creating an engineering advisor position to monitor the technical aspects of MDC's projects. The Inspector General recommends that this concept be expanded to include monitoring of administrative and financial aspects of MDC projects as well. This Independent Audit Unit, which should report directly to the Commission, would monitor compliance with MDC's established policies and procedures governing planning, consultant selection, contracting, invoice approval, and other project management controls. Quality problems, schedule delays, cost overruns, and other deficiencies unreported

through the project management system would thus be brought to the attention of the Commissioner.

2. The Parks Division should ensure that all project engineers are qualified, and that their workload assignments are manageable. Implementation of this recommendation will be difficult until the Parks Division succeeds in hiring additional qualified engineers to whom projects can be assigned. To the extent that MDC can postpone non-essential projects until the Parks Division's engineering capacity is increased, MDC should do so. In addition, MDC should require its project engineers to demonstrate administrative skills as well as technical expertise. MDC's future decisions governing recruitment, hiring, promotion, and termination of engineers should also reflect the importance of administrative competence and performance. (Recommendations for developing administrative capacity within MDC's engineering staff are presented in Chapter Ten, which reviews the agency's personnel management function.)

3. MDC should implement a milestone monitoring and reporting system for design and construction contracts. All contracts should contain milestones, and should specify a schedule and a product for each milestone. Project engineers should prepare written evaluation reports at project milestones. Division managers should review these reports, and the Contract Administrator should keep the milestone reports on file for tracking and evaluation purposes.

4. MDC should establish a set of guidelines for invoice approval. There appears to be no justification for the current practice of checking the same arithmetic three times during invoice approval. The project engineer should not be responsible for reviewing dollar amounts shown on the invoice; the Contract Administrator's staff and the Finance Office can identify and correct mathematical errors. Rather, the project engineer should conduct a substantive review of the work performed to date before approving an invoice for payment. This review could take the form of a telephone conversation or meeting with the consultant, or a review of deliverables received at contract

milestones. In the case of a construction contract, the project engineer should review project status with the resident engineer before approving the contractor's invoice for payment. By linking invoice approval to the monitoring process, the Parks Division can increase the accountability of consultants, contractors, and project engineers.

5. MDC should institute a project tracking system to facilitate analysis, forecasting, and performance evaluation. The Contract Administrator's office should aggregate the project status information contained in the Work Schedule Forms and Exception Reports, and disseminate the resulting analyses and forecasts to division managers and the MDC Commission. In addition, the Contract Administrator's office should update the wall-sized chart of large MDC projects on a monthly basis. The chart should be accessible to division managers, project engineers, and other MDC employees and interested parties.

6. MDC should establish and enforce a clear, consistent policy governing preparation and use of exception reports. Such a policy will increase the value of exception reports as a monitoring tool for Parks Division managers, the Contract Administrator, and the MDC Commission.

7. The Parks Division should forward copies of all Final Review Committee Reports on completed construction projects to the Contract Administrator. The Contract Administrator should use these reports to track the status of construction projects and to document MDC decisions concerning release of retainage.

8. The Parks Division should require project engineers to prepare a written summary at the completion of each project. The summary should document all significant events and problems during the design and construction phases of the project. The summaries should be handled in the same manner as Work Schedule Forms and exception reports: the project engineer should submit them to the Director of Project Planning and Management, who should review the summaries and forward them to the Contract Administrator each month. The Contract Administrator should review the summaries and submit them to the

MDC Commission each month. By disseminating the project summaries to decision-makers at all levels of the agency, the Parks Division can begin to incorporate the agency's experience on past projects into planning and management decisions affecting future design and construction work.

9. The Parks Division's Project Planning and Management section should maintain a complete, accessible set of project files to facilitate project tracking and oversight. The Project Planning and Management section should hire or redeploy sufficient clerical staff to maintain these files for efficient tracking.

10. The Parks Division should institute a formal sign-off system to ensure that operating and maintenance concerns are considered during project design and construction. As recommended by the McKinsey study, all consultant products submitted from the 50 percent contract milestone through completion of the design phase should be reviewed by a representative from the operations and maintenance section as well as by the project engineer. The operations and maintenance representative should also review construction progress at each contract milestone. Both the operations and maintenance representative and the resident engineer should be responsible for notifying the project engineer of potential operating and/or construction problems. The project engineer should communicate these problems to the consultant or contractor and to division management.

CHAPTER NINE

MAINTENANCE

Introduction

MDC's parks and recreation network covers approximately 15,000 acres of reservations and open space and 17 miles of coastal land. It includes salt water beaches, skating rinks, tennis courts, swimming pools, stadiums, zoos, golf courses, playgrounds, a downhill ski area, and a variety of other facilities and structures. Also included within the Parks Division's jurisdiction are miles of roadways, which run through MDC's open space network, as well as 100 vehicular bridges and 40 footbridges. Maintenance of these diverse physical facilities is an important division function; MDC's massive network of parks, reservations, and recreational facilities is an extraordinary public resource which should be preserved in a condition that permits full public use.

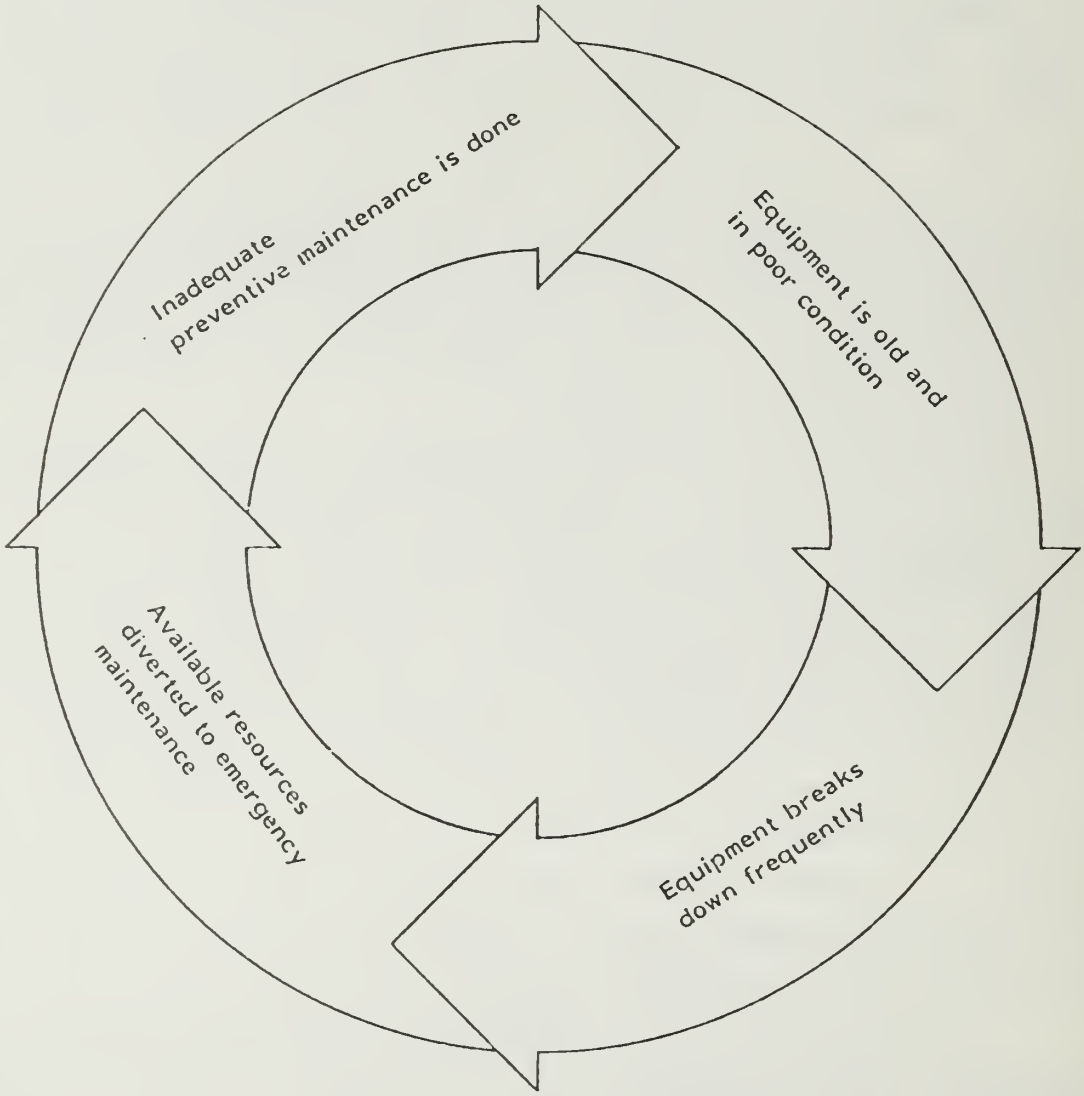
The Central Services Division is responsible for vehicle maintenance on all MDC-owned rolling stock and maintenance of the MDC office building and 19 MDC-owned houses located on reservations. Most other maintenance is carried out at the division level by the Parks, Water, and Sewer Divisions. Within the Parks Division, maintenance is the responsibility of the Reservations and Recreation section, which is comprised of four parks districts, each headed by a district superintendent. The four district superintendents, who are responsible for operating as well as maintaining the facilities in their districts, report to the Director of Reservations and Recreation, who reports to the Parks Division Director. The Parks Division's bridge program manager is responsible for supervising bridge inspection, which is performed by a two-man crew, and bridge maintenance, which is performed by maintenance staff within the MDC districts.

In a 70-page document entitled Revitalizing Operations and Maintenance in the Metropolitan District Commission, the 1981 McKinsey report characterized maintenance of MDC facilities as a "vicious cycle" of inadequate preventive maintenance, poor equipment, and insufficient resources. (See Figure F.)

One of the case studies presented earlier, Three Charles River Bridges (Chapter Three), reviewed MDC's maintenance efforts; because MDC failed to

Figure F

McKinsey Depiction of MDC
Maintenance Operations


Inadequate preventive maintenance is done
Equipment is old and in poor condition
Equipment breaks down frequently
Available resources diverted to emergency maintenance

Source: Revitalizing Operations and Maintenance in the Metropolitan District Commission (New York: McKinsey & Company, Inc., March 4, 1983), p. 2.

require the consultant to conduct a "hands-on" inspection of the three bridges, the consultant performed a visual inspection and, as a consequence, seriously underestimated the need for extensive repairs to all three bridges. That case revealed evidence of serious maintenance deficiencies: the extent to which such deficiencies continue to exist is assessed in the following section.

McKinsey's Recommendations Concerning Maintenance

To break the vicious cycle of poor maintenance, McKinsey recommended that MDC:

- perform a "one-time catch-up" to replace or recondition certain equipment;
- establish and/or strengthen preventive maintenance systems;
- adopt performance standards for operations and maintenance activities; and
- institute a management reporting system to enable comparison of actual performance with the adopted standards.

As the findings which follow indicate, the Parks Division has not implemented these recommendations: two years after the McKinsey's study completion, the division continues to lack a coherent, comprehensive maintenance program to protect and preserve the MDC parks and recreation system -- a resource estimated by the Senate Ways and Means Committee to represent a public investment of $1 billion.

Finding 1.

The Parks Division Fails To Systematically Identify And Plan For The Maintenance Needs Of MDC's Parks And Recreation System, Thereby Inviting Wastefully High Repair Costs and Public Safety Hazards

The Parks Division has not undertaken a comprehensive assessment of the division's preventive and remedial maintenance requirements. According to the Director of Reservations and Recreation, his staff are in the process of developing a list of the four districts' preventive maintenance needs; however, the list is only half-completed. It does not include performance standards, maintenance plans, or schedules: the Director of Reservations and Recreation stated that "we don't have that level of sophistication yet."

Because the Parks Division does not systematically identify its maintenance needs, it is unable to estimate the total resources required to address these needs. Moreover, actual maintenance expenditures are not tracked. Maintenance staff, supplies, and equipment are not budgeted in a single line-item or account, and division staff are therefore unable to pinpoint current expenditure levels for preventive and remedial maintenance.

The McKinsey study recommended that the Parks Division establish a management reporting system which would regularly compare the division's performance in the maintenance area with performance standards developed by the division. The standards, according to McKinsey, should encompass a broad range of maintenance performance indicators, including cost, reliability, quality, and adherence to preventive maintenance schedules. The McKinsey report also recommended a procedure and schedule for revising performance standards annually.

Systematic comparisons of actual maintenance performance against realistic standards would benefit the Parks Division in several ways. Performance information would furnish division managers with a basis for allocating scarce

maintenance resources (staff and equipment). In addition, the information generated by the system could be used for workload planning, performance evaluation, and assessment of staff training needs.

Two years after the McKinsey study's completion, the Parks Division still has neither performance maintenance standards nor a performance reporting system. The Parks Division Director states that the system proposed by McKinsey "made sense," and adds that the division is examining the feasibility of adopting the study's recommendations. However, it appears that the Reservations and Recreation section, which is responsible for all division maintenance, has received no direction concerning implementation of the McKinsey system. When asked if he had ever seen the McKinsey report concerning operations and maintenance, the Director of Reservations and Recreation replied, "I'm sure I have," but added, "You'll have to refresh my memory" concerning the report's content.

The Director of Reservations and Recreation attributes many of these deficiencies to inadequate funding for maintenance; he stated that in recent years, the Legislature has not increased MDC's appropriation beyond prior year levels (plus an inflation allowance). He also indicated that when MDC is level-funded, all units and functions within the agency also tend to be level-funded. However, a 1982 report by the State Auditor attributed the inadequacy of funding levels for parks maintenance in recent years to the Parks Division's failure to identify those maintenance requirements:

> "Our review of the division's annual budgetary requests indicated that repair and maintenance data are based on employee staffing levels and current year expenditures...rather than on identified needs. The lack of identified needs inhibits [budget] reviewers from accurately targeting funding levels to needs."

MDC's Executive Assistant to the Commissioner in charge of finance confirmed that the Parks Division's budget requests are still not tied to estimates of maintenance needs; rather, they are based upon the prior fiscal year's budget request, plus an inflation allowance.

The financial and public safety consequences of MDC's failure to develop an effective maintenance program are illustrated by the history of the Harvard Bridge (also called the "Mass. Ave. Bridge"), which MDC is responsible for inspecting and maintaining. In 1972, MDC hired a structural consultant, Dr. Kenneth Leet, to

evaluate the condition of the Harvard Bridge. The consultant told MDC that the bridge's expansion joints required "considerable maintenance"; outlined a series of required repairs; advised MDC to prevent trucks weighing over 15 tons from using the bridge (in order to avert "local failure and injury to users of the bridge"); and recommended that MDC replace the bridge superstructure (excluding the foundation), on the grounds that the bridge's strength was 30 to 50 percent below that required for the loads it carried. The consultant estimated the cost of the new superstructure at $3 million. Moreover, the consultant's report to MDC emphasized that the firm MDC had hired to measure and inspect the bridge, Hub Testing, had not furnished adequate or complete inspection data; consequently, the consultant noted, the report's analysis was based on the optimistic assumption that no portions of the bridge structure were loose or deteriorated.

Despite the fact that Hub Testing had not produced the required inspection data, and that MDC had reason to question the firm's integrity,[1] MDC did not commission another inspection of the Harvard Bridge until 1983 -- 11 years later. Moreover, MDC did not undertake the maintenance and repair work which the 1972 consultant report had cited as necessary during the period between 1972 and 1983. MDC did post signs for a 15-ton limit; however, the signs were located at the bridge entrance, where overweight trucks were unable to turn around and exit before crossing the bridge. Finally, in June 1983 -- one week after a bridge collapse in Connecticut drew national media coverage -- MDC provided a truck detour route and closed the two outside lanes of the Harvard Bridge, reporting that cracks had been discovered in the metal hangers connecting the pins at the bridge's expansion joints -- precisely the location cited as high risk by the 1972 consultant report. As of June 1983, replacement of the bridge superstructure will take at least four years, and will cost well over $12 million. MDC's failure to implement the recommendations of its own consultant has led to a tripling of repair

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[1] This inspection firm, Hub Testing, had held an annual contract to test MDC materials since 1948. During the five years prior to 1972, Hub Testing had tested the materials for three major non-MDC structures which subsequently collapsed, causing multiple deaths and injuries in each case. The most serious incident was the collapse of a Brighton apartment building in 1971: four workmen were killed. A subsequent investigation by the City of Boston revealed that Hub Testing had only performed the required tests on the building materials on 35 percent of the days when tests should have been conducted, had failed to report defective concrete, and had failed to test the batch of concrete which ultimately gave way. These and other revelations about Hub Testing were widely publicized in 1972.

costs; more importantly, prudent measures to protect public safety during the 11-year period between 1972 and 1983 were not taken.

In addition to creating public safety hazards, the Parks Division's continued failure to develop an effective maintenance program could cause MDC to lose more than an estimated $20 million in Federal aid for the reconstruction of the Harvard Bridge and two Alewife Brook Parkway bridges. The Federal Highway Administration (FHWA), which distributes aid for bridge reconstruction, requires recipients of FHWA funds to meet established FHWA standards for bridge maintenance and inspection. In November 1980, FHWA requested documentation of MDC's bridge maintenance program. The request stated, in part:

> "So as not to jeopardize future Federal-aid funds because of possible inadequate maintenance we suggest that the MDC prepare a maintenance plan stating how Federal-aid highway projects under their control should be maintained. The plan should include such items as an organization chart, inspection procedures and scheduled, maintenance procedures and schedules, etc."

Twenty months later, in July 1982, MDC submitted a one-page letter in response to FHWA's request. The letter described MDC's maintenance plan as follows:

> "In the past few years the Commission has set a policy that in early spring each of these bridges are cleaned of the winter sands and debris, followed by the flushing and washing of the expansion joints, scuppers and drain lines.
>
> Other maintenance work is done or scheduled to be done when a problem is reported.
>
> The majority of the reports are received from one or more of the following sources:
>
> (1) Bridge Inspection Team
> (2) Metropolitan District Commission Police
> (3) Divisional Foremen
>
> A form is being prepared and distributed to the above units for standard reporting. These forms will be forwarded to David Lenhardt, in charge of the MDC Bridge Program for action. The forms will not only be used for Federally funded bridges but all bridges under the ownership of MDC."

According to FHWA's Structures and Safety Engineer, who was responsible for evaluating MDC's plan, this reply was not acceptable to FHWA, since MDC had failed to submit an organization chart as well as detailed inspection and maintenance procedures and schedules. The FHWA engineer also expressed concern over MDC's policy of waiting for problems to arise before performing preventive bridge maintenance. In a September 1982 memorandum, FHWA notified MDC that further maintenance information was required in order to fulfill FHWA's request.

Subsequently, MDC submitted a four-page document to FHWA. The first page was an organization chart of MDC's bridge inspection and maintenance functions. Page two was a memorandum from MDC's bridge maintenance engineer to the Parks Division Director. It stated:

> "The Bridge Maintenance Program is now in its infancy and we have just started a program of doing maintenance on all Bridges.
>
> I feel in the beginning that at least once a year we should do the following:
>
> a. Cleaning and flusing [sic] out drain lines
> b. Washing of expansion joints and scuppers.
> c. Cleaning catch basins at the end of each bridge
> d. In house maintenance of bridge decks.
>
> The above has been completed and we hope that this can be done 2 - 3 times a year as the program is promulagated [sic].
>
> We have patched holes that required form work and poured the concrete. We have patched decks that have spalled areas. We have replaced several feet of expansion joints in a few bridges. We have replaced missing drain covers with wooden covers until new ones can be made. The next major job to be done on the bridges is to clean the top of back wall and bridge seats. Over the years, much debree [sic] and sand has accumulated.
>
> FOOT BRIDGES
>
> We have 45 foot bridges to maintain. At this point we have washed down the decks of dirt and sand and dog dirt from 22 of them. We have cleaned drains, and replaced missing drain covers which were a hazard to the public. We have had to fix railings on the stairs as

well as patched the decks on some foot bridges that have spalled. We also have cut grass and tree limbs around some of the bridges.

As we progress I foresee the work load increasing and then we will have to set some priorities."

Finally, pages three and four listed the MDC bridges which were to be inspected over the subsequent 12-month period. According to the previously-cited FHWA official, his agency is currently reviewing this four-page document.

Clearly, MDC's response falls far short of a detailed action plan for bridge inspection and maintenance. The memorandum does not specify inspection procedures or work schedules, nor does it assign priorities to MDC's bridges based upon their maintenance requirements. Without this information it is difficult to see how the Parks Division can assure FHWA or the MDC Commission that bridges for which MDC is responsible will be properly inspected and maintained.

Finding 2.

The Parks Division's Managers Report That They Lack Both The Staff And The Equipment Needed To Maintain The Division's Facilities

Parks Division officials and staff unanimously contend that the division lacks sufficient personnel and equipment to properly maintain MDC's parks and recreation system. However, because the division has not systematically identified maintenance personnel and equipment requirements, the Inspector General was unable to evaluate conclusively the division's assertion that its current maintenance resources are grossly inadequate. The available evidence for that assertion is summarized below.

According to the Director of Reservations and Recreation, the size of the Parks Division's maintenance staff has been reduced by 40 percent since 1974, primarily through attrition. He stated that the resulting shortage of plumbers, electricians, and other skilled craftsmen has prevented the division from properly maintaining its facilities. Consequently, he stated, the division's approach to

maintenance tends to be "reactive rather than proactive: we're reduced to putting out brushfires." Since 1974, the Parks Division has experienced a 30 percent reduction in year-round personnel and a 23 percent reduction in seasonal personnel, according to statistics compiled by the Executive Office of Environmental Affairs (EOEA), MDC's umbrella agency.[2] During this same period, MDC continued to acquire land and construct facilities, thereby increasing the division's maintenance responsibilities and overextending its existing maintenance capacities. EOEA has characterized the Parks Division's personnel reductions over the past decade as "devastating to the quality of maintenance the MDC has been able to deliver over this period."

According to several district superintendents, the Parks Division's maintenance forces are too few in number and lack the necessary training and experience to carry out their duties. One district superintendent stated that the Parks Division places heavy reliance on unskilled seasonal workers (whom he characterized as "winos" off the street) to maintain the division's bridges and roads. Another district superintendent stated that his maintenance force is qualified only to mow lawns and pick up litter. District maintenance forces also lack adequate landscaping training and experience, according to division landscape architects; they stated that 10 to 15 percent of the trees throughout MDC's parks system may be dying from neglect and mistreatment stemming from the inexperience and carelessness of district crews.

Division managers state that the shortage of qualified maintenance staff has led to an increasing reliance on consultants, who are hired to identify maintenance needs, and contractors, who are hired to repair neglected facilities and structures. The Three Charles River Bridges case (Chapter Three) demonstrates the extent of the division's reliance on consultants: although MDC's own inspection crew had inspected the three bridges in 1978, MDC hired a consultant in early 1979 to reinspect the bridges and to design the necessary repairs. Currently, the Parks Division is in the process of hiring a consultant to inventory maintenance needs throughout MDC's network of parkways. According to the division's program manager in charge of parkways, this inventory cannot be done by division staff because they lack the required expertise. (If division staff do indeed lack the

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[2] Feasibility Analysis of Merging DEM and MDC Parks Programs (Boston: Office of Policy and Management Analysis, Executive Office of Environmental Affairs, January 1983).

expertise to conduct needs assessment of MDC's parkways, then their ability to effectively monitor the consultant contract would seem questionable.)

In addition, the Director of Reservations and Recreation states that the Parks Division's maintenance equipment is both poor and incomplete. District superintendents corroborate the Director's assessment, stating that the maintenance equipment assigned to the districts is old, in poor condition, or defective. One district superintendent reported that for years he has made annual requests for equipment necessary to adequately maintain facilities assigned to his district; however, these requests have not been granted. Typically, the parks districts cope with shortages of functioning maintenance equipment in two ways: either they compete with each other and with other MDC divisions for use of available equipment, or they rent it. These strategies tend to be time-consuming, costly, and inefficient. For example, in September 1982 the Parks Division lacked the required equipment -- a pavement saw, a small jackhammer, and an air compressor -- to fill the potholes on the Gilmore Bridge. Therefore, the district rented both the pavement saw and jackhammer and borrowed an air compressor from another district. According to the district superintendent, none of his crew had experience operating a pavement saw; consequently, the project was delayed until the crew learned how to operate the equipment.

The example of bridge inspection and maintenance illustrates the resource shortages referred to above. A Parks Division official within the Project Planning and Management section (which oversees bridge inspection activities), who is a licensed professional engineer, described the bridge inspection team as "maintenance-oriented," and added that the Department of Public Works (DPW) is the only State agency with a qualified bridge inspection team. The Parks Division's bridge program manager, who supervises the bridge inspection team, stated that since he is the only person qualified to assign load-carrying capacity ratings to the bridges, most ratings are done by consultants.

Moreover, MDC currently lacks a bridge maintenance program, according to the head of bridge maintenance at MDC. He stated that in September 1982, he was assigned by the Parks Division Director to start such a program; however, bridge maintenance activities are restricted to minor tasks -- such as drain cleaning and concrete paving -- because of the inadequacy of MDC's bridge maintenance staff and equipment. He added that MDC typically hires consultants to

perform more complex maintenance and repair tasks. MDC's bridge program manager concurred that MDC's maintenance personnel are capable of doing bridge maintenance work only if it is not "extensive."

Recommendations Concerning Maintenance

Parks Division officials readily acknowledge that the division has not devoted sufficient attention to maintaining its facilities. They explain that MDC is constantly subjected to political pressures to expand, even though the agency's maintenance capabilities are already overtaxed. The Parks Division Director states, for example, that bridge maintenance has been neglected because of pressure on MDC to "build, build, build." MDC's parks and recreation system has indeed expanded considerably in recent years. Between 1970 and 1983, 1,000 acres of parklands were added, causing a substantial increase in MDC's maintenance workload. During that same period, maintenance requirements were further increased by construction of new recreational facilities, including seven skating rinks, three swimming pools, and three park developments. MDC also obtained additional park sites, such as Belle Island Marsh and Stony Brook Reservation. In short, as stated earlier, the Parks Division's maintenance resources have decreased, rather than increased, as the division's facilities have expanded.

MDC has done little to improve the systematically deficient maintenance of the many valuable public facilties entrusted to its care. An unwritten policy of subordinating facility maintenance to facility expansion seems largely responsible for this state of affairs. But the Commission's failure to implement McKinsey's recommendations for revitalizing its maintenance function probably also stems, at least in part, from MDC's demonstrated incapacity for integrated planning and effective project management -- two essential elements in any successful large-scale maintenance program. Accordingly, concrete steps required to revitalize MDC's maintenance function, such as those recommended below, are unlikely to prove sufficient in themselves until MDC develops the capacity to manage maintenance programs and projects effectively, and until MDC establishes a comprehensive planning system into which planning for maintenance needs can be integrated. MDC should assign a higher priority to maintenance of the parks and recreation system. Chronic undermaintenance will continue to threaten the Commonwealth's $1 billion investment in MDC's facilities unless the Commission works to halt the current cycle of expansion, underfunding of required maintenance,

neglect, and progressive deterioration of MDC facilities. In order to initiate badly-needed improvements in this area, the Inspector General makes the following recommendations:

1. The Parks Division should create a maintenance planning unit within the Reservations and Recreation section. This new unit should first undertake a comprehensive assessment of the Parks Division's preventive and remedial maintenance needs; this needs assessment should be updated annually. The unit should then develop and monitor standard inspection and maintenance policies, procedures, and schedules for all parks and recreation facilities, including bridges. The unit should also prepare maintenance cost estimates for all proposed construction and expansion, and continuously track the division's maintenance expenditures.

2. The Parks Division should adopt an explicit maintenance plan. Based on the updated needs assessment described in the previous recommendation, the new maintenance planning unit should draft a maintenance program plan containing criteria, priorities, and schedules for inspection and maintenance of division facilities. The plan should also identify the division's maintenance staff and equipment requirements. The completed plan, which should be reviewed and approved by the Director of Reservations and Recreation and the Parks Division Director, should be incorporated into the Parks Division's master plan as well as its annual budget request. After approving the plan, the Parks Division Director should submit it through proper channels to the Federal Highway Administration, thereby making MDC eligible to receive Federal aid for bridge reconstruction.

3. The Parks Division should ensure that maintenance personnel are adequately qualified. The Division Director should ensure that all maintenance personnel have the skills, experience, and training they need to carry out the tasks specified in the maintenance plan discussed above. In particular, the Parks Division should assign at least one structural engineer to supervise MDC's bridge inspection team on a daily basis in order to minimize the hazards of unsafe bridge conditions.

4. The Parks Division should institute a maintenance information system. The new maintenance planning unit should design and administer a maintenance reporting system for evaluating maintenance activities within the division. The reporting system should compare actual performance against performance standards. The maintenance planning unit should submit quarterly status reports summarizing its evaluation findings to the Parks Division Director and the Director of Reservations and Recreation, both of whom should use this performance information as a basis for staff and equipment requests, workload planning, employee performance evaluation, and employee training plans.

5. The MDC Commission should ensure that all budget requests submitted by the Parks Division contain sufficient funds for maintenance of existing facilities as well as new facilities scheduled for completion during the fiscal year. The Commission should disapprove Parks Division budget requests that fail to ensure that the funding required to properly maintain the division's existing and proposed new facilities is or will be available. The Commission should defer proposed expansion projects for which sufficient maintenance resources will be unavailable.

CHAPTER TEN

PERSONNEL MANAGEMENT

Introduction

The issue of personnel management is central to any analysis of MDC's past, present, and future capabilities. Without a sufficient number of competent engineers, who are supervised by effective managers, MDC cannot hope to rectify past deficiencies, regardless of the number and type of management systems it implements.

The case studies illustrate that lack of technical expertise on the part of key MDC engineering personnel has led to serious problems. In the General Lawrence Bridge project (Chapter One), MDC's failure to recognize major errors in the consultant's design calculations caused lengthy project delays and could have led to disaster: if the bridge had been constructed as originally designed, each one of the three major design errors would in itself have caused the bridge to collapse under normal use. (Fortunately, the designer responsible for the errors changed jobs, and MDC's consultant hired a new designer who checked and corrected the calculations.) The Tenean Beach rehabilitation project (Chapter Two) included a granite wall which MDC's project engineer mistakenly believed would serve as a flood barrier despite the fact that the design provided for openings for pedestrian access at approximately every 20 feet; this wall will cost MDC close to $100,000. MDC's failure to specify proper bridge inspection methods for the Three Charles River Bridges project (Chapter Three) caused MDC to dramatically underestimate the extent to which these three bridges had deteriorated: as a result, essential repairs were delayed for over four years. (One bridge still has not been repaired.) MDC's approval of questionable work methods during the George's Island Pipeline project (Chapter Four) led to major cost overruns and schedule delays: the project cost was more than four times the original estimate, and the initial project schedule of one month was exceeded by 16 months.

In addition to deficiencies stemming from the inadequate technical qualifications of MDC's project engineers, the case studies contain numerous examples of mismanagement at all levels of the organization. MDC's poor planning

and project selection practices contributed to MDC's decision to redevelop a seriously polluted beach. MDC used idiosyncratic and undocumented procedures to select the consultants for all three design contracts. (The George's Island Pipeline project did not involve a design consultant.) And in all four cases, MDC's inadequate supervision and control over the project contributed to cost overruns and delays. Examples include MDC's approval of excessive contract overhead rates (General Lawrence Bridge), MDC's overpayment to a contractor (George's Island Pipeline), and MDC's delays in resolving contract problems (General Lawrence Bridge, Tenean Beach, and Three Charles River Bridges.)

The delays, cost overruns, and design and construction deficiencies evident in the case studies of Parks Division projects seem to have stemmed in large measure from three recurrent problems associated with the division's engineering personnel. First, there is a shortage of individuals qualified to function adequately as engineers. Second, there is a shortage of individuals qualified to manage and oversee MDC's projects. Third, there is widespread belief, from top management down, that both project planning and engineering judgments should be left to MDC's contract consultants --that monitoring of consultants by MDC engineers is not possible (because MDC engineers are not capable of evaluating consultants' work), not necessary (because consultants know what they are doing; that is why they are hired), and perhaps not appropriate (because consultants are "professional outfits"; they do not have to be checked). Until these three fundamental problems have been remedied through effective personnel management action, the waste found in the case studies is likely to be repeated in other MDC projects.

Personnel management was one of the major areas addressed by the 1981 McKinsey study. In a volume entitled Strengthening Personnel Management, McKinsey identified a number of needed improvements. This chapter considers whether those recommendations have been implemented and whether the three fundamental personnel problems noted above have been corrected.

McKinsey's Recommendations On Personnel Management

Although MDC hired McKinsey & Company, Inc. in part to recommend ways to improve personnel management at MDC, MDC's own Personnel Office staff state that they never received copies of the final report McKinsey submitted in April 1981, nor did they receive any direction regarding implementation of McKinsey's recommendations. Despite MDC's substantial investment of staff time and one-half million dollars in the McKinsey study, two years after publication of the report, MDC continues to lack the personnel systems McKinsey recommended. MDC has neither:

- a long-range staffing plan;
- a system for monitoring hiring and promotion activities;
- a performance appraisal system;
- a staff training plan and budget; nor
- an efficient, accurate record-keeping system.

Part of the reason that so little has been accomplished is that the personnel function has been largely neglected in recent years. Between 1981 and 1983, MDC lacked a full-time Personnel Director, and during that period, the remaining personnel staff apparently received little or no direction from the Commission.

In January 1983, however, a new Personnel Director was hired. MDC now has an opportunity to rectify its long-standing personnel deficiencies. The findings which follow, developed from the Inspector General's review of MDC's current personnel practices and systems, outline the problems which need to be addressed.

Finding 1.

The Parks Division Lacks The Qualified Staff Required To Manage MDC's Design And Construction Projects

According to the Parks Division Director, the 24 engineers assigned to manage the division's projects are unable to understand or review the engineering calculations prepared by MDC's design consultants for the major structural projects the division routinely undertakes. Furthermore, the Director does not expect his project engineers to be able to do so; he believes that since the division hires consultants with this specialized expertise, the division's staff need not be as highly qualified. The Director stated that he does expect the project engineers to review plans and specifications prepared by design consultants for completeness and conformity to division standards. However, it is not clear how project engineers can accurately determine the completeness of calculations they cannot understand.

With regard to bridge design work, the Division Director stated that he would expect the division's bridge program manager to be more knowledgeable in the area of design calculations than the division's other project engineers. However, the bridge program manager has stated that the consultant's design of the General Lawrence Bridge (Chapter One) -- which he was required to review -- was beyond his expertise.

The potential consequences of the division's inability to review structural calculations are sobering. At least half of the Parks Division's approximately 40 current major projects[1] involve building or rehabilitating buildings, bridges, rinks, piers, and dams; for these projects, MDC hires consultants to prepare the structural plans, specifications, and calculations. For approximately 20 major projects, then, MDC lacks the expertise required to verify the consultants' work. Thus, if a consultant submitted structural plans containing serious errors in calculating the strength of wind, tidal, or other forces --any of which could

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[1] The source of this project information is the Parks Division's fiscal year 1982 and fiscal year 1983 Program document.

ultimately cause the bridge or building to crack or collapse, MDC's project engineer would be incapable of discovering these calculation errors.

In addition, the two officials who oversee the division's engineering projects, both of whom are licensed Professional Engineers, assert that the number and caliber of division engineers are insufficient to handle the division's projects. The Director of Project Planning and Management states that the division is forced to assign "unqualified" engineers to projects due to the insufficient number of qualified engineers. His assistant summarizes the problem as follows: "Let's face it: many people are in positions above their capabilities."

By statute, any person who practices engineering -- defined as any professional service requiring engineering, training, and experience, including "investigation, evaluation, planning, design and supervision of construction for the purpose of assuring compliance with specifications..."[2] -- must be registered as a Professional Engineer by the State Board of Registration. The statute does permit unregistered persons to perform engineering work, provided that "such work does not include final designs or decisions and is done under the direct responsibility, checking and supervision of a person holding a certificate of registration...."[3] MDC's personnel records show that only six of the 24 project engineers responsible for managing and monitoring the Parks Division's design and construction projects are registered Professional Engineers. (One is a registered Landscape Architect.) Fourteen have college or advanced degrees in engineering disciplines; seven have neither a Professional Engineer license nor an engineering degree.

Of the 73 Parks Division employees with engineering titles, only one-eighth (nine) are Registered Engineers, and only one-third (24) have college or advanced degrees in engineering disciplines. Over half (42) of these employees with engineering titles have neither a Professional Engineer license nor an engineering degree.

The Parks Division Director acknowledges that the division needs more experienced engineers with Professional Engineer licenses to provide expertise and lend credibility to the division. However, he states that project engineers who

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[2] Massachusetts General Laws Chapter 112, section 81D.

[3] Massachusetts General Laws Chapter 112, section 81R.

lack expertise in certain areas -- for example, landscape architecture -- are expected to seek out the division's landscape experts for assistance and advice. However, the Tenean Beach case (Chapter Two) indicates that project engineers do not necessarily follow the advice of experts. A horticulturist hired by the design consultant recommended that MDC reduce the size and scope of the planting program planned for the beach, due to the exposed nature of the site. However, MDC's project engineer rejected the horticulturist's advice on the grounds that the public was "in no mood for a barren area."

Despite the acknowledged need for highly qualified staff, the division has not recruited experienced staff in recent years. The reasons for this are discussed in Finding 2, below.

Finding 2.

The Parks Division Staffs Almost All Senior-Level Engineering Positions By Internal Promotion, Thereby Missing Opportunities To Upgrade The Division's Engineering And Administrative Capacity

New positions within MDC must be approved by a number of State agencies, including the Budget Bureau and the Department of Personnel Administration (DPA); they must then be voted on by the House and Senate Ways and Means Committees. According to MDC staff, approval for new positions is difficult to obtain. In general, therefore, no one is hired or promoted unless an existing position is vacant. Where vacancies occur, most are filled by internal promotion, for the reasons discussed below.

Finding 2a.

The A&F critical need approval process discourages external recruitment and encourages excessive internal promotions

When a vacancy occurs, due to an employee's retirement, departure, or promotion, it may not be filled unless "critical need approval" is obtained from the Executive Office of Administration and Finance (A&F). This approval is also called "83-2 approval,"[4] which refers to the A&F Administrative Bulletin 83-2 on this subject; this approval has been required since a statewide hiring freeze took effect in January 1980. In theory, 83-2 approval is required regardless of whether the vacant position is to be filled via outside recruitment or internal promotion. However, MDC staff have observed that 83-2 approvals tend to be granted routinely only for internal promotions. Moreover, when MDC submits a request for 83-2 approval to fill a vacant position via outside recruitment, A&F normally takes three to six months to respond, and sometimes fails to respond at all, according to MDC personnel and finance staff. In contrast, MDC generally promotes employees to existing vacancies without waiting for A&F's response to the 83-2 request, since such requests are always granted. Thus, the critical need approval process apparently creates a strong incentive for all divisions of MDC to promote from within.

Parks Division managers attribute the division's failure to recruit high-level engineers to the obstacles posed by the critical need approval process. This argument cannot be confirmed with certainty, since available records of 83-2 requests are inadequate: neither MDC's Personnel Office nor A&F has maintained chronological records of MDC's requests for critical need approval and A&F's disposition of those requests. The Parks Division's records indicate it has submitted only two critical need approval requests to A&F in recent years: four Junior Civil Engineer positions were requested in May 1980, and one Junior Civil Engineer position was requested in March 1983. According to Parks Division staff, A&F did not respond to the 1980 request. (A spokesman for A&F stated that A&F

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[4] On March 10, 1983, A&F issued Administrative Bulletin 83-2, which contains stricter requirements for the approval and supersedes the previous Administrative Bulletin 80-2.

notifies an agency of the disposition of its critical need approval request only if the agency's request has been approved; otherwise, the request is held until the end of the fiscal year, at which time it becomes "moot.") The more recent Parks Division request has apparently not yet been processed by A&F.

The available evidence does indicate that the Parks Division has not attempted to recruit outside candidates to fill upper-level engineering vacancies: both requests for critical need approval cited above involved entry-level positions. Whether or not A&F would have approved requests to fill upper-level engineering vacancies is not known, of course, but MDC's policy of filling vacancies by internal promotion appears to be attributable, at least in part, to its expectation that A&F will not approve requests to fill vacancies by external recruitment.

By filling vacancies through internal promotion, MDC can reward good performance and capitalize on the experience of its most competent employees. However, the Parks Division's near-exclusive use of internal promotions to fill vacancies narrows MDC's hiring choices, creates pressures to over-promote unqualified individuals, and deprives the agency of a resource it badly needs: the knowledge and expertise of engineers trained in modern engineering and project management methods.

Finding 2b.

The Parks Division's reliance on provisional promotions to fill vacancies perpetuates the division's staffing deficiencies

There are three types of appointments to vacant positions: temporary from a civil service certification list, permanent from a certification list, and provisional. The first two types of appointments involve several requirements and delays; both require that the candidate meet all the civil service requirements for certification, including satisfactory completion of a position-related examination. DPA holds the examinations, evaluates all applicants for the position, and issues a certification list of qualified candidates from which the agency may hire.

By contrast, provisional appointments, which do not require civil service certification, can be made quickly. Managers can hire provisional employees "off the street," in the words of one MDC staff member, as long as the vacancy has

received 83-2 approval and the candidate meets the official qualifications of the position. But critical need approval is easiest to obtain for internal promotions; thus the provisional promotion is the most frequently-used method of filling vacancies within the Parks Division. Accordingly, all but a few senior-level engineering positions are occupied by provisional appointees who were promoted from lower positions within the division.

Because MDC tends to rely on provisional internal appointments to fill vacancies, the retirement or departure of an employee at the top of the engineering hierarchy tends to trigger a chain reaction of provisional promotions all the way down the ladder. Promotions to key engineering positions, it thus appears, are not decided solely on the basis of engineering competence. Rather, ones chances of promotion hinge primarily on two factors: ones current position within the hierarchy (which may have been reached via prior provisional promotions), and the retirement rate of those at the top of the hierarchy.

The McKinsey study reported that MDC's workforce in professional and skilled positions has a median age of 50. (For the Parks Division, the median age is closer to 53.) The study further reported that approximately 34 percent of the division's professional and skilled employees are between the ages of 56 and 65, and estimated that one person within this group will pass the age of 65 each month for the next ten years. If the current practice of routine internal promotions continues, this high retirement rate will pull the division's current engineers upward within the organization at a steady pace; inevitably, some individuals will be promoted into positions for which they are neither suited nor officially qualified. The Parks Division's inability to staff key project management positions with qualified individuals thus seems likely to persist for the foreseeable future.

Finding 2c.

DPA's civil service schedule may impede certification of qualified candidates to MDC engineering positions

The infrequency with which open competitive examinations have been held in the past eight years has created an additional barrier to external recruitment by MDC. If MDC chooses to fill a civil service position vacancy and receives 83-2

approval to do so, MDC may request that DPA hold an examination to fill the vacancy. This examination is either an open competitive examination, which may be taken by any applicant, or a promotional examination, which may only be taken by employees with civil service certification. MDC may request either type of examination. The examination produces a list of certified candidates, rated by DPA, from which MDC may hire. The list is considered "active" for two years.

According to DPA staff, civil service examinations are held on an "as needed" basis during an 18-month cycle: that is, the examination for a given position is held at least every 18 months and may be held more often. However, since 1976, DPA has not held examinations for engineering positions every 18 months, despite the existence of vacancies and absence of candidates on active lists. DPA staff cited two main reasons for this situation: insufficient funds, and commitment of DPA resources to a major position reclassification plan which was submitted to the Legislature in 1980.

DPA's General Counsel states that the examinations are now back on schedule. According to an Examination Bureau staff member, the most recent open competitive examinations for the positions of Junior and Assistant Civil Engineer were held by DPA's Examination Bureau in August 1981; however, the active lists of candidates passing those examinations were not established until January 1983. Since DPA lists remain active for two years, the Examination Bureau does not plan to schedule new examinations for these engineering positions for at least one year.

One would suspect that few applicants who took the qualifying examination in 1981 would still be available for recruitment 17 months later. Under these circumstances, it is hardly surprising that Parks Division managers with pressing staff shortages choose to fill vacancies promptly, by provisional internal appointment, rather than awaiting completion of the civil service examination and certification process.

Finding 2d.

Starting salary levels and advancement opportunities for MDC engineers appear inadequate to attract qualified candidates

There appears to be unanimous agreement among MDC and DPA staff interviewed that current starting salaries for MDC engineering positions are not competitive with those offered by private engineering firms in the metropolitan Boston area. MDC and DPA staff also agree that the low starting salary levels for MDC engineering positions discourage applicants.

Applicants who are willing to accept the specified salary often cannot pass the certification examinations, according to DPA staff. Moreover, qualified candidates who might be willing to accept a lower salary in return for advancement opportunities and job security will not find such inducements: MDC's reliance on provisional promotions to fill vacancies has left few positions available for advancement or permanent civil service certification. This situation arises because candidates who are hired as permanent employees from certification lists "own" their positions. If subsequently appointed to higher positions on a temporary or provisional basis, they retain the right to reoccupy their original permanent positions unless they obtain civil service certification and permanent status in their new positions. Thus, an employee hired or promoted temporarily from a certification list into a vacant position cannot obtain civil service protection or permanent status in that position if the position is "owned" by someone else further up the ladder. Even if open competitive examinations were held more frequently, then, MDC might still find it difficult to attract highly qualified candidates.

Finding 3.

The Parks Division's Internal Controls Over Hiring And Promotion Of Engineers, Especially At The Upper Levels, Are Inadequate To Ensure That Key Engineering Positions Will Be Filled By Qualified Individuals

Within the Parks Division, most upper-level engineering positions -- that is, above the Assistant Civil Engineer level -- are held by individuals who have neither passed a qualifying examination nor received civil service certification in their current positions. MDC lacks evidence that Parks Division engineers meet the State eligibility requirements for their positions. Without such evidence, MDC is incapable of evaluating the adequacy of the State certification process as a mechanism for ensuring that those engineers responsible for managing multi-million dollar projects are qualified to do so.

Finding 3a.

Half of the Parks Division's upper-level engineers are exempt from civil service requirements and oversight

MDC has approximately 2,500 employees, of whom 194 are exempt from civil service hiring and promotion regulations. These exempt positions, considered temporary for payroll purposes, were formerly concentrated in the Construction Division and are now dispersed throughout the MDC organization. The titles, job specifications, salaries, and fringe benefits of these exempt positions are identical to those of the civil service positions. However, unlike civil service vacancies, vacancies in the exempt positions can be filled at the appointing authority's discretion as long as funds are available; no "critical need approval" is required. DPA records show that roughly half of the Parks Division's engineers above the assistant (grade 19) level occupy exempt positions. They were hired without being tested, and they can be promoted into higher exempt positions without being tested. DPA's authority over these exempt positions is limited to issuing position specifications and recording MDC's personnel actions; DPA does not have the

statutory authority to require evidence from MDC that appointees to these exempt positions meet the official job specifications for the positions.

Finding 3b.

A high proportion of Parks Division employees are provisional appointees who have never been certified by DPA to their current positions

Provisional employees occupy all but a few of the Parks Division's upper-level engineering positions which are not exempt from civil service requirements. A number of these provisional appointments have been in effect for many years.

In theory, the provisional appointment is an interim measure. After MDC makes a provisional appointment, DPA is required to generate an eligibility list of candidates who have passed the qualifying civil service examination. If the provisional appointee's name is not on the certification list, the appointee loses the job to a candidate who has been certified from the eligibility list. If the appointee's name is on the list, the appointee is certified to the position as a temporary or permanent civil service employee. One might expect that this procedure would enable MDC to meet urgent staffing needs on an interim basis by making provisional appointments, later ensuring that those appointees meet State eligibility requirements for the engineering positions they hold.

In fact, provisional appointees have not been routinely tested and either certified to their positions or replaced. MDC records show that a number of MDC employees -- most of them engineers in the Parks Division -- have held provisional appointments for many years. The following five examples are drawn from Parks Division records.

Provisional Appointment	Years in Provisional Position	Permanent Civil Service Position
Senior Engineering Aide	12½	None
Senior Civil Engineer	11	None
Assistant Civil Engineer	10	Junior Civil Engineer
Assistant Civil Engineer	9½	Senior Civil Engineering Draftsman
Senior Civil Engineer	7½	Assistant Civil Engineer

As the list shows, the two Parks Division employees with the longest tenure in their provisional positions have never been certified to any MDC position. The others "own" positions below those they occupy provisionally. These examples demonstrate that a provisional appointment to an engineering position within the Parks Division can have long-lasting negative consequences for the division: as the previous discussion has shown, provisional appointees are able to advance to positions of considerable responsiblity without being tested for their new jobs; moreover, the lack of available civil service positions discourages qualified outsiders from working in the Parks Division.

Finding 3c.

Job specifications for engineering positions provide insufficient guidance for personnel decisions

The vague wording of the eligibility requirements listed in the engineering position specifications in use at MDC further contributes to the difficulty of ensuring appropriate hires and promotions. For example, the DPA specification for the position of Associate Civil Engineer lists 20 examples of position-related duties, including:

- supervises and administers the survey section on all work;
- develops proposed maintenance budget and program within a highway district and supervises approved program;
- acts as resident engineer on a major project of extraordinary complexity; acts as supervisor of resident engineers on several major projects of major complexity.

The qualifications listed for the position are reproduced in their entirety below:

"1. Thorough knowledge of civil engineering principles and practices;

2. Marked ability to plan, organize, direct and coordinate engineering work of considerable [sic] complex and diversified nature;

3. Marked ability to apply engineering principles to the solution of complex engineering problems;

4. Considerable ability to make accurate engineering calculations of a highly complex nature and to check the work of others;

5. Ability to establish and maintain effective working relationships with subordinates, superiors, associates and the public contacted in this work;

6. Ability to write clear and concise reports."

The position specification does not indicate the number of years or type of experience required for eligibility. When DPA holds an examination, the published announcement does specify the years of experience required; however, exempt and provisional appointees are not required to take civil service examinations. MDC may request clarification or advice from DPA regarding eligibility requirements at any time; but according to DPA staff, MDC managers rarely do so. Rather, MDC managers apparently interpret the wording of the qualifications in the specifications as they see fit. Unfortunately, the phrases "thorough knowledge," "marked ability," and "considerable ability" in the Associate Civil Engineer position specification shown above are sufficiently ambiguous as to provide MDC managers

with enormous latitude in deciding upon an individual's qualifications for an exempt or provisional appointment to this key supervisory post.

Finding 3d.

Neither MDC nor DPA systematically reviews MDC's key management appointments

The mechanisms for monitoring the consistency and appropriateness of MDC's personnel actions appear very inadequate. To make a provisional appointment to a vacant position, a manager simply completes a form stating that the appointee meets the eligibility requirements for the position. The form is sent to the MDC Personnel Office, which forwards a copy of the form to DPA. Similarly, appointments to exempt positions merely require that MDC send DPA a copy of the personnel action. According to MDC personnel staff, the MDC Personnel Office only reviews those appointments for nonmanagement, unionized positions. Approximately 16 positions within the Parks Division are designated management positions, and are exempt from union regulations. The Personnel Office does not review the Division Director's appointments to these 16 management positions. However, according to the Supervisor of Personnel Management, DPA must approve each managerial appointment before it can take effect.

By statute, DPA is responsible for monitoring State agencies' compliance with State personnel laws and regulations. However, DPA staff state that MDC's actions would be scrutinized only if DPA received a specific complaint from a manager or employee at MDC, and that since no such complaints have been received in recent memory, no efforts have been made to audit MDC's personnel actions. One DPA staff member characterized DPA's philosophy as "let the agencies run the agencies." He emphasized that DPA is available to assist the agencies, but lacks sufficient resources to exert control over their personnel activities. It would appear, then, that MDC cannot rely on DPA to audit MDC's personnel decisions. MDC must therefore assume full responsibility for ensuring that hiring and promotion

at MDC are based upon objective, verifiable criteria which reflect the needs of the organization.[5]

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[5] As the foregoing discussion indicates, the policies and procedures of the Department of Personnel Administration both contribute to MDC's personnel problems and could help to resolve them. One problem outlined in this chapter -- the high proportion of provisional appointees -- was addressed by the Legislature in Massachusetts General Laws Chapter 767, Acts of 1981; DPA is responsible for fulfilling the terms of that legislation. Another problem affecting MDC -- the inadequacy of existing job specifications -- was addressed by DPA in a proposal to the Legislature in June 1980. These activities are described below.

Chapter 767. Under the terms of section 26 of Massachusetts General Laws Chapter 767, Acts of 1981, DPA is required to design and implement an examination procedure to qualify provisional appointees for civil service status. DPA is in the process of compiling data submitted by all State agencies, including MDC, indicating the number and dates of service of all provisional employees. According to DPA staff, eligible provisional appointees will take promotional examinations for their positions. Those who pass will be certified to their current positions; those who do not pass will be either demoted to the positions they "own," or terminated. To be eligible for this procedure, an employee must have worked in a provisional position for at least six months prior to June 11, 1981, or the employee must have previously passed a State civil service examination and served provisionally without interruption of service for more than two years.

DPA has yet to identify those State employees who would be subject to this special certification procedure. Most upper-level MDC engineers in provisional slots would be eligible, based on the criteria cited above. DPA's schedule for holding the required examinations is not yet available.

Reclassification Plan. DPA is responsible for developing the specifications and eligibility requirements for all MDC positions. The specifications currently in use were originally developed in 1956, according to the Director of DPA's Bureau of Classification. In June 1980, DPA submitted a revamped State reclassification plan to the Legislature. According to DPA staff, the plan includes revised job specifications which are based on a comprehensive analysis of all non-management positions within the State government. To date, the Legislature has not approved the DPA proposal.

Finding 4.

MDC Lacks Systems For Evaluating Employee Performance, Identifying Staffing Deficiencies, And Designing Strategies To Upgrade Performance

Over the past several years, MDC has hired several consultants to design and implement personnel systems for MDC. Despite the substantial investment of MDC funds and staff time in these consultant contracts, none of the recommended personnel systems have been implemented. As a result, management controls over the productivity and effectiveness of MDC employees continue to be inadequate.

Finding 4a.

MDC lacks a performance appraisal system

In late 1980, MDC's Personnel Office suspended its existing performance appraisal system and began to design a new one. Between late 1980 and September 1981, three performance appraisal training manuals were prepared under the direction of MDC's personnel director. (Soon after the manuals were published, the Director became terminally ill and left MDC.) The manuals consisted of a training manual, an appraiser's guide, and an employee's guide. Current MDC staff do not know whether the manuals were written by the Personnel Director or by someone else within or outside MDC.

In August 1981, MDC hired an outside consultant, Linda Sayre, to coordinate and present a performance appraisal training program for 400 MDC employees. MDC files indicate that her training material was drawn exclusively from the three performance appraisal manuals produced by the Personnel Director. According to MDC's files, the consultant conducted a series of two-day training sessions for MDC employees in September, October, and early November of 1981. Invoices furnished by MDC indicate that the consultant was paid approximately $9,600 for this work.

During the same period in which the Personnel Director was preparing the three manuals, MDC commissioned McKinsey to review management systems, structure and staffing levels at MDC. One of the report volumes, entitled Strengthening Personnel Management, is a 67-page summary of McKinsey's personnel recommendations. The document advocates a complete overhaul of internal personnel management at MDC, and recommends that MDC:

1. establish personnel performance evaluations;
2. expand the amount and quality of job-related training;
3. develop streamlined procedures for personnel selection and promotion; and
4. create a modern record-keeping system.

Included in the document is a sample performance appraisal system which appears to have been developed independently of the three manuals prepared by MDC's Personnel Director.

When the Personnel Director became ill in late 1981, the Supervisor of Personnel Management assumed responsibility for personnel operations. However, although she reports that she did attend a training session conducted by Linda Sayre, she received no information or instructions from the Commission regarding implementation of either of the two performance appraisal systems designed for use by MDC. According to the Supervisor of Personnel Management, Strengthening Personnel Management was never shown or distributed to the staff of the Personnel Office, although these same employees had compiled data for use in the study.

Thus, despite the design of two separate performance appraisal systems for MDC, formal evaluations of the performance of MDC's employees have not been conducted since the old performance appraisal system was suspended in late 1980.

An effective performance appraisal system, which thoroughly documents staff capabilities at all levels of the organization, would benefit MDC in at least three critical areas. First, it would alert managers to staffing deficiencies which could then be rectified through redeployment or replacement of staff in the problem areas. Second, it would motivate employees to excel by providing them with regular feedback on their performance and by serving as a basis for promotion

decisions. Third, it would enable managers to identify and address the organization's training needs.

As the previous findings have shown, most MDC engineers with key project management responsibilities have been promoted by their managers to their current positions on a provisional basis -- that is, without civil service certification. The absence of performance appraisals at MDC raises serious questions regarding the objectivity and reliability of the provisional promotions which have been made by MDC managers since late 1980. It would appear that MDC lacks the necessary tools to reward employee performance, analyze the effectiveness of current staff assignments, and evaluate the training needs of its work force.

Finding 4b.

MDC does not plan or budget for staff training

Over the past decade, MDC has been advised to institute in-house training programs by several sources, both in-house and external. However, no such programs have been implemented to date.

In a memorandum to the Chief Engineer dated March 10, 1975, the Supervising Civil Engineer, who is now the Parks Division Director, recommended that an in-service training program be established to instruct personnel in areas such as proper use of inspection reports, basic blueprint reading, computation of estimates, and performance evaluation. Six years later, the McKinsey document entitled Strengthening Personnel Management, which was commissioned by MDC and published in February 1981, strongly recommended that MDC invest in expanded employee training efforts. The sample performance appraisal system designed by McKinsey for supervisory and engineering personnel included preparation of an annual development and training plan for each employee. The McKinsey study also recommended that the Personnel Office designate a training manager who would be responsible for collecting and distributing information regarding training programs which might be of interest to MDC personnel, reviewing each division's training plan and budget, and tracking and reporting on the division's effectiveness in executing training plans. The performance appraisal system developed by MDC's Personnel Director in early 1981 also declared MDC's commitment to staff training.

Notwithstanding the emphasis on training found in all of the above documents, no funds for training of any kind are ever included in MDC's yearly budget request, according to the Executive Assistant to the Commissioner in charge of finance at MDC. When an employee or manager attends a seminar or conference, the payment is made out of subsidiary account 13, in which MDC budgets funds for industrial accident payments.

Division managers readily acknowledge that some project engineers lack the requisite expertise to perform their duties. Yet, according to the Director of the Parks Division, all training furnished to engineers is on-the-job training. The Parks Division apparently responds to the training needs of its employees by assigning them large volumes of highly responsible work, presumably in the expectation that, sooner or later, the employees will acquire the necessary skills to manage their projects. While this type of on-the-job training may well be appropriate for some employees, the risks of project mismanagement and employee frustration argue against exclusive reliance on this approach.

Finding 5.

MDC's Inefficient Personnel Record-Keeping System Hinders Effective Personnel Management

Previous findings have discussed the importance to MDC of effective internal control systems for monitoring hiring and promotion, evaluating employee performance, and designing corrective training plans. Should these systems be implemented, an accurate, efficient personnel record-keeping system will be essential to their successful operation.

The McKinsey report identified MDC's "outdated, massive, manual [personnel] systems" as a major problem confronting the agency and recommended three actions designed to modernize and decentralize the MDC's personnel record-keeping system:

- "Hire a software applications consultant to develop and/or install a single computerized record-keeping system that can be used by each Division's Personnel department.

- Formally place responsibility for updating personnel records in each major Division -- and stop updating the Personnel card files.

- Make the [MDC] Personnel department responsible for setting and enforcing policies on personnel and payroll records, e.g., requirement to balance MDC and state payroll records, payroll updates, access to personal information."

The MDC has disregarded all of these recommendations. MDC staff members interviewed did not know why the MDC Commissioner included the personnel area in the scope of the McKinsey study, and then excluded it from all post-McKinsey implementation activities. However, one personnel staff member recalled that the Commissioner (Geoghegan) was adamant in his opposition to the above recommendations on the grounds that they would be too costly to implement.

All employee records on file at the Personnel Office are maintained manually; as a consequence, even minor updates or changes to employee records tend to be time-consuming and error-prone. The Personnel Office maintains personnel records for all MDC employees; each MDC division also maintains its own set of personnel files. For the Parks Division, the Personnel Office maintains three separate employee files corresponding to the three payroll accounts from which Parks Division employees are paid: 2440 (formerly Parks and Recreation), 2450 (formerly Highway Engineering), and 2460 (formerly the Construction Division). The three units listed above were combined into one unit, the Parks Division, during the 1981 MDC reorganization. Nevertheless, the MDC continues to maintain separate payroll accounts and employee files. According to the Personnel Office, this practice is required by the Executive Office of Administration and Finance.

Theoretically, the MDC's manual personnel records should generally agree with the computerized MDC employee statistics on file at the Department of Personnel Administration, since the MDC's Personnel Office sends copies of all personnel actions to the DPA. In fact, however, the DPA's statistics on MDC personnel bear little resemblance to those compiled by the MDC. For example, for the week of January 4, 1983, MDC's Personnel Office records indicate that 2,471 MDC positions were filled. The DPA's statistical report for the same period lists 2,825 filled positions. DPA staff blame this discrepancy, which representatives of both agencies agree is quite typical, on MDC's slowness in forwarding personnel actions.

MDC has not taken steps to computerize its personnel records, despite the fact that MDC has an IBM 370 computer and a ten-person data processing section. According to the Executive Assistant to the Commissioner in charge of finance, these resources are not available for new in-house projects. Some of the largest users of MDC computer and staff time are other agencies within the jurisdiction of the Executive Office of Environmental Affairs, MDC's umbrella agency. MDC has not charged these agencies for their use of MDC's data processing resources, despite MDC's legislative authority to do so under Chapter 191 of the Acts of 1982. This practice of donating costly staff and computer time to other agencies seems difficult to justify, in view of MDC's documented need for computer resources.

Recommendations Concerning Personnel Management

The performance of the Parks Division, MDC's largest construction unit, clearly is seriously undermined by the pervasive deficiencies evident in MDC's current personnel system. These deficiencies, in all likelihood, also impair the performance of MDC's other construction divisions. Given the apparent high cost of these deficiencies, the MDC Commission should make a firm commitment to the urgent task of revitalizing MDC's personnel resources and systems. To carry out its commitment, the Commission should assign the highest possible priority to implementing the recommendations which follow. The many fundamental improvements needed in MDC's personnel management systems will require actions not only by MDC, but also by other State agencies. To these agencies, as well as to MDC, the Inspector General makes the following recommendations:

1. The MDC Commission should convene a Task Force on Professional Performance to analyze all MDC engineering positions. To ensure an objective perspective on MDC's staffing needs, the MDC Commission should appoint private sector engineers, technical project managers, and personnel administrators to the task force (also discussed in Chapter Eleven of this report). The task force should define each position's principal responsibilities, including those which pertain to contract administration, staff supervision, and organization management, as well as those which pertain to engineering. The skills, knowledge, and other qualifications required to discharge each responsibility successfully should be specified in a manner that facilitates reliable evaluations of existing and prospective staff.[6] In addition, the task force should compare current salary ranges for MDC engineering positions with those of comparable positions at other public agencies and at private engineering

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[6] Should the Legislature approve the reclassification plan which has been submitted by DPA, MDC should reconvene the task force to evaluate the position specifications contained in the reclassification plan. Where the DPA plan specifications differ significantly from the revised specifications produced by the MDC task force, MDC should file a request with DPA to adopt the more recent specifications designed by the MDC task force.

firms. Based on the results of this review, the MDC Commissioner should request that the Executive Office of Administration and Finance (A&F) adjust upward those MDC salary ranges which are substantially below competitive levels. In the case of unionized positions, the MDC Commissioner should request that A&F negotiate salary ranges which are roughly comparable to those paid by other public agencies and private firms.

2. MDC should implement a performance appraisal system. MDC has invested months of staff time and thousands of dollars in developing staff performance appraisal systems. Close to 400 MDC employees have attended two-day sessions during which they were trained in the use of the system developed by MDC's former Personnel Director. Three instruction manuals for the systems have already been printed. This system is virtually ready to implement, and does not differ substantively from that proposed by McKinsey & Company, Inc. MDC should evaluate this system, modify it as necessary, and implement it. MDC's Personnel Director should oversee the new system's operation and monitor all evaluation forms to ensure compliance within the divisions.[7]

3. MDC should implement a complete staff training and development program for each division. Given the Parks Division's serious problems in recruiting qualified professional staff and managing engineering projects, an explicit training program and budget appear essential. It is likely that other MDC divisions would also benefit from emphasis on staff training. Investment of MDC staff, time, and resources in training engineering employees -- especially employees who manage multi-million dollar design and construction projects -- will in all likelihood be far outweighed by the savings that should result from reductions in project cost overruns, delays, and construction deficiencies.

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[7] At some point in the future, MDC's operational system may be affected by the Department of Personnel Administration, which was required by Chapter 767, Acts of 1981 to design a performance appraisal system for all State personnel by July 1, 1982. DPA staff have stated that they are working on the system, but cannot furnish details regarding its components or completion date at this time. MDC should not wait for DPA to complete their system. MDC badly needs staff performance appraisal now, and the Commission has a virtually complete system that was designed specifically for MDC. MDC should implement this system as soon as possible.

As the performance appraisal system recommended above begins to produce evaluations of staff performance, individual training needs will be identified. Division managers will then be able to identify the training most needed by their employees. Managers should submit all requests for employee training to their division heads, who should formulate division training programs, entering their funding requirements as separate line-items in their annual budget requests. Responsibility for approval and oversight of all training plans should be assigned to a training manager within MDC, as recommended by McKinsey. The training manager should ensure that training activities reflect the basic needs and priorities of the organization: for example, training in cost estimating, project management, and other administrative skills should be provided to project engineers whose many responsibilities include overseeing the work of consultants and contractors. The training curriculum should make it clear to all project engineers that they are indeed responsible for monitoring, and will be held accountable for controlling, the performance of MDC's consultants and contractors.

4. MDC's Personnel Office should develop a long-range staffing plan for each MDC division. The high proportion of Parks Division employees nearing retirement age indicates that vacant positions will continue to increase in the foreseeable future. The age profiles contained in the McKinsey study indicate that the other MDC divisions can also anticipate high retirement rates over the next decade. The Personnel Office should analyze and periodically update the McKinsey data. In addition, the Personnel Office should work with division planners to estimate future staffing based on projected workload requirements. By developing staffing plans for the divisions, MDC will be better equipped to prepare budget requests and initiate hiring procedures in response to present and anticipated staffing shortages.

5. MDC should recruit outside candidates for current and future engineering vacancies within the Parks Division. The Commission should establish a policy of recruiting outside candidates to compete for vacant engineering positions. The request for critical need approval is the necessary first step in the

recruitment process. McKinsey's report outlined a streamlined procedure for preparing such requests: divisions would write the required justifications, and the Personnel Office would review and record the requests in a central log. The Personnel Office would also maintain a master file of position assignments to confirm that positions requested by the divisions are vacant and funded. MDC should implement these recommended procedures.

6. The Executive Office of Administration and Finance should approve MDC requests to recruit outside candidates for engineering positions which are vacant and funded. MDC's critical need for highly-qualified engineering staff should be recognized by the Executive Office of Administration and Finance. If the Parks Division is to obtain the expertise necessary to manage the division's current and future project workload, MDC must be permitted to fill vacancies by external recruitment.

7. The Department of Personnel Administration should hold open competitive examinations to fill MDC's engineering vacancies if existing "active" lists contain no suitable or available candidates. To recruit experienced engineers from outside the organization to fill vacant, funded positions, MDC must either hire from the "active" lists maintained by the Department of Personnel Administration, or request that DPA hold open competitive examinations to establish a new list. Since open competitive examinations may be taken by MDC employees as well as non-employees, this procedure maximizes the range of hiring choices available to MDC managers and permits career growth by qualified MDC employees.

   The Department of Personnel Administration should respond promptly to MDC's requests for engineering examinations and certification lists. By doing so, DPA will reduce MDC's incentive to fill existing vacancies by provisional promotions.

8. MDC should computerize its personnel and payroll records. The Executive Office of Administration and Finance has recently developed the computerized Payroll/Personnel Management Information System for use by State agencies.

MDC should work with the Executive Office of Administration and Finance to install this system, which is currently operating at several State sites, at MDC.

9. After records have been computerized, responsibility for maintaining and updating personnel files should be assigned to the divisions. As recommended by the McKinsey study, MDC should eliminate the current practice whereby the MDC Personnel Office and the divisions maintain duplicate sets of personnel records. By doing so, MDC will reduce the amount of staff time devoted to records maintenance, thereby enabling MDC's Personnel Office to devote more resources to oversight of personnel-related activities and controls.

10. MDC should adopt a data processing policy which accords highest priority to MDC projects and requires outside agencies within the Executive Office of Environmental Affairs to reimburse MDC for their use of MDC data processing resources. MDC's Finance Office should develop a schedule of data processing charges based upon the full cost (including overhead) of MDC staff and computer time. Outside agencies within the Executive Office of Environmental Affairs[8] using MDC's data processing resources should be billed on a monthly basis, starting immediately.

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[8] Massachusetts General Laws Chapter 191 of the Acts of 1982 permits MDC to enter into interagency agreements with any State agency within the Executive Office of Environmental Affairs for the purpose of recovering the cost of data processing services furnished by MDC.

PART III

RECOMMENDATIONS AND CONCLUSION

CHAPTER ELEVEN

IMPLEMENTATION STRATEGIES AND PRIORITIES

The Inspector General recommends that MDC implement the recommendations for change outlined in Chapters Five through Ten in accordance with the following strategies and priorities:

1. MDC should immediately establish a three-part organizational spearhead for change. First, the Governor should establish a Task Force on Professional Performance to define the concrete responsibilities and required qualifications of all key engineering and administrative positions within MDC's central staff and Parks Division. The Task Force, whose members should include private sector professionals in the fields of personnel management, management consulting, and civil engineering, would work closely with MDC's Personnel Director and report directly to the MDC Commissioner. The Task Force's most immediate objective would be to recommend the staff qualifications, size, and organization of the new MDC Independent Audit Unit (proposed below). The Task Force's next immediate objective would be to develop and recommend an integrated system of job descriptions, responsibility allocations, and performance appraisal procedures that would enable MDC, within 12 months, to conduct fair and objective evaluations of all key engineers and managers within MDC's central staff and Parks Division. Upon achieving these objectives, the task force would be disbanded.

   Second, the Governor should appoint a Management Assistance Team, comprised of private and public sector volunteers who have demonstrated significant accomplishments in the fields of organizational management, engineering, and engineering administration, to provide immediate technical support to MDC's current engineers and administrators. The Team would be supported by a small, full-time professional staff of engineers, managers, and management analysts. Candidates for this staff would be recommended by the Management Assistance Team and hired by the MDC Commissioner. These staff positions, which would not be permanent elements within MDC's organizational structure,

would be exempted from civil service requirements by legislation filed by the Governor. In approximately one year -- after MDC's performance evaluations of existing personnel indicate positions which need to be filled -- the individuals who had worked as the Management Assistance Team's temporary full-time staff could apply for those available positions, at which point civil service requirements would then be applied.

Among its contributions, the Management Assistance Team would help MDC's present engineering and management staffs by providing, as appropriate:

- training in engineering and management fundamentals;
- exposure to new engineering and managerial techniques;
- orientation towards management attitudes;
- professional development opportunities;
- analysis and advice on specific engineering and managerial problems;
- direct assistance in planning, designing, and managing high risk MDC projects;
- direct assistance in supervising and evaluating staff; and
- help in developing and implementing needed improvements in MDC's basic management systems.

The Management Assistance Team would be dissolved once MDC establishes effective systems for providing the above services through the agency's regular employees.

Third, the MDC Commissioner should establish a permanent Independent Audit Unit to monitor and report on the extent to which MDC's high risk projects are planned and executed efficiently, effectively, and in compliance with the Commission's policies and State statutes. This unit would also report directly to the Commissioner on progress and problems in rebuilding MDC's management capacity as recommended by this report. The unit's staff should include

individuals with backgrounds in investigation, accounting, engineering, and organizational management.[1]

2. MDC should immediately review all significant current Parks Division projects. As its first priority, MDC's new Independent Audit Unit should identify opportunities for preventing further waste in the Parks Division's current projects. The Independent Audit Unit's review should focus on all Parks Division projects which either a) involve estimated construction costs of $100,000 or more, b) have a history of cost overruns, schedule delays, or deficient work, or c) would seriously hinder progress towards one or more of the division's program area objectives if over budget, late, or poorly executed. The unit should review each project's financial controls, payments, and history; project management; and engineering design. In designing and executing these reviews, the Independent Audit Unit should report directly to the MDC Commissioner.

   To the extent that corrective actions recommended by the Independent Audit Unit would be implemented or facilitated by the Management Assistance Team, the Team should involve itself in helping to implement those actions as its first priority.

3. MDC should immediately begin upgrading the qualifications of its key professional personnel. Chapter Ten outlined needed improvements in the personnel management systems of both MDC generally and the Parks Division specifically. Although the considerable improvements needed in both areas undoubtedly will take a good deal of planning and time, as well as cooperation by other agencies, MDC should take immediate steps to begin increasing its capacity for effective personnel management. Specifically, working with the three spearhead units mentioned above, MDC should take the following actions:

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[1] According to senior MDC officials, MDC is in the process of developing a plan for the creation of an internal audit unit.

- Within six months, MDC should complete and adopt a workable system for evaluating the qualifications and performance of all Parks Division managers, from the Parks Division Director to the project engineers who manage the division's individual projects.

- Within six months thereafter, MDC should complete an initial appraisal of all Parks Division managers. The appraisal should identify all individuals whose performance is substantially deficient. In addition, the appraisal should recommend concrete actions for upgrading deficient performance by individual managers including -- as appropriate -- reorientation, retraining, reassignment, and replacement.

- No later than three months thereafter, the Independent Audit Unit should conduct an independent assessment of all remedial reorientation and retraining efforts referred to above. Based on this assessment, the Independent Audit Unit should recommend to the MDC Commissioner any further retraining, reassignments, and replacements of managers necessary to achieve adequate capacity in the Parks Division's key management positions.

- Within the timetable outlined above, MDC also should establish and carry out performance appraisals of its central management staff (including, but not necessarily limited to, the Contract Administrator, the Planning Director, and the Personnel Director), as well as those employees who provide MDC's primary engineering and engineering quality control services.

- Based on the above performance appraisals and follow-up studies, the MDC Commissioner should determine the type and number of new employees needed to establish adequate engineering, financial, and managerial capacity in the Parks Division and in MDC's central staff.

- The Commissioner should then apply for critical need approvals, request civil service examinations, and take all other measures necessary to hire the needed new employees as rapidly as possible.

4. MDC should immediately establish, issue, and enforce written policies to guide Parks Division activities and projects. Among other things, these policies should:

   - require that past performance of potential consultants and contractors be carefully considered in MDC selection decisions (see recommendation 1, page 100 and recommendation 1, page 108);

   - require that procedures for evaluating consultant and contractor qualifications and proposals be uniform (see recommendation 2, page 100 and recommendation 3, page 109);

   - separate MDC's contracts for project studies and project designs (see recommendation 2, page 86); and

   - establish maintenance standards and budgets, and require that they be met (see recommendation 2, page 146).

   Compliance with these and other MDC policies by all significant Parks Division projects should be checked by the Contract Administrator, and monitored on a sample basis by the Independent Audit Unit. Sanctions for staff deviation from these policies should be established and enforced.

5. MDC should immediately develop and begin to execute an effective plan for implementing this report's recommendations. In developing and executing this plan, MDC should:

   - Make the plan comprehensive. Given the broad extent and close interrelatedness of MDC's many deficiencies, correction of those

deficiencies seem likely to require nothing less than a coherently organized and broadly comprehensive program which addresses all major problems simultaneously.

- Make a strong commitment to implement the plan. The plan should be developed, to the maximum extent possible, by public officials rather than contract consultants. Public officials should be personally committed to the plan's contents and should be held personally accountable for its implementation. A single public official, reporting directly to the MDC Commissioner, should be made responsible for the plan's success and should be given the resources and authority required to achieve that success.

  The Secretary of Environmental Affairs and the Assistant Secretary of Administration and Finance for Management should help the MDC Commissioner draft MDC's initial comprehensive improvement plan, and should periodically consult on the plan's refinement and implementation. This plan's implementation should be supported as strongly as possible by the Governor and the MDC Commissioner.

- State the plan's goals, objectives, and strategies. The plan should specify long-range goals (four to five years) and measurable short-term objectives (one year or less). For each objective, the plan should answer these questions:

  - What resources will be made available? When? How?
  - What tasks and activities will be undertaken?
  - Who will be held responsible for meeting the objective?
  - By when will the objective be met?
  - How will progress toward the objective be measured and reported?
  - How will efforts to achieve the objective be coordinated with efforts to achieve the other objectives?

These questions should address each of the actions recommended in this report and any alternative measures MDC may prefer to take to remedy the weaknesses identified by the report.

- Monitor the plan's implementation. Overall progress toward meeting the plan's objectives should be monitored systematically within MDC by the Independent Audit Unit recommended earlier. This unit, which would report directly to the Commissioner, would periodically recommend such changes in the plan as appear necessary to maintain progress towards meeting its goals and objectives. Progress reports on the plan's implementation should be scheduled, frequent, and public.

6. MDC's annual project workload should be reduced as required to ensure that all MDC managers have the time necessary to participate intensively in implementing all of this report's recommendations. The MDC Commissioner should review the agency's currently scheduled projects and identify those which should be postponed in order to make sufficient time and resources available to properly develop and initiate MDC's comprehensive improvement plan. The agency's capital and operating budget request for fiscal year 1985 should reflect these reduced project activity levels. This budget request should also include all new funding required to carry out the improvement plan during the fiscal year.

7. The Legislature should allow MDC sufficient time and funds to implement this report's recommendations. In order to give MDC an opportunity to concentrate on making the comprehensive improvements recommended in this report, the Legislature should avoid overtaxing the agency with new mandates that expand its current programs and facilities. If urgent design and construction projects must be undertaken during this temporary slowdown in assigning new projects to MDC, the Legislature should assign those projects to other appropriate public agencies wherever possible. Less urgent projects should be postponed. The Legislature should give serious consideration and all possible support to MDC requests for funds to implement this report's recommendations.

CHAPTER TWELVE

CONCLUSION

The case studies and management system reviews summarized in the preceding pages of this report raise serious doubts concerning MDC's capacity to carry out its legislated responsibilities effectively and economically. Because our report focused on MDC's Parks Division, one cannot be certain that the widespread deficiencies clearly evident in that division are present to the same extent in the Water Division, the Sewer Division, the Police Division, and the Commission's other operating units.

However, in the course of reviewing the Parks Division's activities and procedures, this report has also reviewed, and found pervasive shortcomings in, some of MDC's most important central management systems -- personnel administration, long-range planning and budgeting, consultant selection, and contract administration. It seems reasonable to conclude that problems in these central systems have caused related problems throughout all of MDC's operating divisions.

Conclusive documentation of any such problems in the Sewer, Water, and Police Divisions would require extensive studies of those units. But the preceding chapters clearly suggest three disturbing conclusions about MDC generally and the Parks Division specifically:

1. MDC's Parks Division is incapable of maintaining its past capital investments. Maintenance needs are not identified. Preventive maintenance is not done. Maintenance budgets are not requested. Maintenance funds are not appropriated. Maintenance priorities are low. MDC's maintenance funds and staffing have been reduced even as facilities have expanded. All of these facts strongly suggest that MDC is incapable of maintaining its past capital investments.

2. MDC is incapable of managing its present design and construction work. MDC's central consultant selection procedures are unreliable, arbitrary, idiosyncratic, and lacking in public accountability. MDC's central contract controls are weak or entirely absent. Cost overruns, missed schedules, and

design and construction defects, which recur in Parks Division projects, reflect underlying inadequacies in MDC's project management systems and serious deficiencies in the qualifications of the Parks Division's managers and engineering staff. The MDC Commission does not effectively oversee its managers; Parks Division managers violate the Commission's approved policies and procedures, substituting their own policies and procedures.

3. MDC is incapable of controlling its future direction. The agency, which spends over $70 million annually in operating funds and millions more in capital outlay funds, has no systematic mechanisms for anticipating and responding to changes in its environment. MDC's central personnel function is entirely inadequate to the task of ensuring that the agency will have the staff it needs to carry out its future work. Planning is accorded a low priority at all levels of the agency. MDC's Planning Office has not updated long-range plans for the Parks Division. The Parks Division selects projects without weighing program priorities, without establishing project selection criteria, and without evaluating the costs and benefits of alternatives. Because MDC is thus unable to anticipate problems and develop orderly plans for meeting them, the agency repeatedly faces crises that consume the energies of its managers, diverting their attention from the crucial management function of preparing for the future.

These three problems seem unlikely to moderate during the foreseeable future, for they stem in large part from what appear to be firmly-held attitudes and predispositions of senior Parks Division managers. That MDC's problems are caused and perpetuated by the attitudes and beliefs of the Parks Division's senior staff is perhaps most clearly illustrated by the example of project management. The McKinsey project management manual, which was formally approved by the Commission, makes the MDC project engineer responsible for "managing and monitoring the substance of the work done by the consultant" and for ensuring that the work performed meets MDC's quality standards and time schedules. Nevertheless, the Director of the Parks Division openly opposes the proposition that project engineers should review design work performed by private consultants under contract to MDC. In his view, consultants are "professionals," and therefore can

be and should be trusted to perform properly on their own. Moreover, the Director asserts, MDC project engineers need not even be qualified to review consultants' design work, for if MDC's own engineers were as highly qualified as professional engineering consultants, then there would be no need for MDC to hire private consultants.

It is evident that the Parks Division Director's philosophy has prevailed. For example, project engineers are not required to report to division management or to the Contract Administrator on the status of contract work at scheduled milestones. Similarly, project engineers are not required to verify that the work billed on invoices received by MDC has in fact been performed; rather, invoices are approved and paid if they appear consistent with contract requirements and their arithmetic is correct. In fact, the Parks Division Director has stated that he has never refused to pay a consultant's invoice. Moreover, neither division management nor the Contract Administrator attempts to anticipate or prevent project cost overruns or delays. And project engineers are not required to document problems and significant events after their assigned projects have been completed.

In short -- the McKinsey manual's prescriptions notwithstanding -- the Parks Division's project management procedures entrust to the consultants who contract with MDC virtually all responsibility for overseeing and controlling their own work. The Parks Division's reliance on consultants to police themselves, which seems questionable in any case, is made to appear even more misguided by MDC's policy of choosing consultants with little consideration of their their past performance.

As the case studies and reviews of MDC's management systems have shown, the Parks Division's officials have implemented McKinsey's recommendations in appearance but not in substance. Thus, new forms and criteria for evaluating consultants have been adopted but are not used. Project justifications are written, but are prepared after, rather than before, projects are selected. Program plans are submitted, but they reflect and ratify project selection decisions that have already been made, rather than providing a comprehensive, informed basis for making these decisions. A planning office has been established, but it does not carry out its responsibilities for comprehensively updating master plans. The need for training is acknowledged, but training funds are not budgeted and training priorities are not established. The maintenance requirements of MDC facilities continue to be virtually ignored.

These interrelated deficiencies reinforce one another. Because the Parks Division Director does not believe his project engineers need to be qualified to review consultants' work, he does not attempt to hire engineers who possess such qualifications. Because his engineers are therefore unqualified, more reliance must be placed on consultants. The more the Parks Division relies on consultants, the less leverage it has to control their work and prevent unjustified cost increases. The less able the Parks Division is to control its consultants' work, the more unanticipated cost overruns, delays, and quality problems in design and construction result. The more such unexpected problems appear, the more Parks Division managers preoccupy themselves with day-to-day crises. The more Parks Division managers focus on current crises, the less they are able to steer the agency towards meeting the requirements of the future.

This report reviewed four MDC projects which had experienced cost overruns. When these cases were selected for review, it was not known that the case studies would also reveal serious engineering defects, lack of management controls, and billing irregularities. Yet the studies uncovered one instance in which MDC approved the design of a bridge destined to collapse, and another in which MDC built a $100,000 wall which the project engineer incorrectly believed would serve as a breakwater but which in fact will serve only as a bench. The studies further revealed incidents of unjustified billings and payment of invoices for work which MDC did not even know was being done.

In hindsight, it is not surprising that such deficiencies were discovered. This report has revealed that many of MDC's Parks Division engineers are unqualified to supervise the agency's major projects, that cost controls are virtually non-existent, and that policies and procedures needed for effective project management are sorely lacking. Thus, there is a compelling need for MDC to review immediately its other current projects for safety and waste, and to halt its expansion into new activities until it can address these problems.

The needed changes recommended by this report are so basic and pervasive that they will surely take considerable effort and time to complete. They are also interrelated, so that a massive, coordinated effort is required; piecemeal efforts will not suffice. Action and support will be needed not only from MDC itself but also from other officials and agencies in the executive branch, from the Legislature, and from the communities which comprise the metropolitan districts.

It can be stated with certainty that without these extensive reforms, MDC will not be able to effectively carry out its public mission.

The problems MDC faces will not be remedied (as MDC's half million-dollar engagement with McKinsey clearly has shown) by contracting for yet another management consultant study while the agency continues to carry out projects that its personnel are neither qualified to execute nor equipped to maintain. Enough time and resources have been devoted to pointing out MDC's long-standing deficiencies. MDC and the Administration now face the challenge of bringing the agency back under control.

APPENDIX

MDC RESPONSE

The Commonwealth of Massachusetts
Metropolitan District Commission
20 Somerset Street, Boston 02108

WILLIAM J. GEARY
COMMISSIONER

September 6, 1983

Mr. Joseph R. Barresi
State Inspector General
One Ashburton Place
Room 1311
Boston, Massachusetts 02108

Dear Inspector General Barresi:

The report you are today releasing examines a number of Metropolitan District Commission Parks Division projects which pre-date my arrival at the agency. Not having been involved in the cases studied, I am unable to make first-hand observations about the facts alleged or the judgments retroactively applied by your office. Nonetheless, this distance is a distinct advantage as it allows me to review objectively the conclusions drawn, compare them with my own examination of agency affairs, and draw on both analyses when making substantial changes over the next several months.

Your report accurately characterizes the Metropolitan District Commission Parks Division as a unit whose numbers have been drastically reduced, leaving an insufficient amount of engineering talent to manage scores of major construction projects. This problem is exacerbated as current employees, whose average age already exceeds 55, retire and the agency is unable to hire replacements due to personnel caps, hiring freezes and budget reductions.

Consequently, the Metropolitan District Commission has increasingly turned to outside consultants to fill this personnel void. Unfortunately, in the short term, the agency suffers because it lacks even the numbers necessary to properly manage and supervise these private firms. Over time, the damage will be even more severe as expertise traditionally generated and retained within the agency is instead acquired by consultants whose commitment to the agency extends no further than the contract expiration date.

So you and I are of one mind; after nearly a century of outstanding service to the region, the Metropolitan District Commission needs an unprecedented infusion of talent. And this new energy must take many forms:

Reorganization of the Parks/Construction Division - As you know, I have spent considerable time this summer reviewing the Parks/Construction Division with an eye toward redesigning its operations. My investigation is nearly complete and this fall I will be discussing its results and my proposed changes with the Governor, Secretary Hoyte and the legislative leaders.

Internal Audit and Management Unit - We have already drawn up comprehensive plans for such a unit. As explained to your office, this new group will be an independent unit, reporting directly to the Commissioner, and have substantial authority to monitor financial, contract and managerial operations in each of the agency's divisions. A funding proposal for this unit is being prepared for inclusion on our upcoming budget request.

Additional engineers and field personnel - While the Internal Audit and Management Unit will enable the Commissioner's Office to lend independent assistance to the Parks Division, that unit, once reorganized, will need additional engineers and field personnel to supervise our many consultants and, indeed, to start the longer term process of making the agency increasingly self-sufficient.

Personnel - Upon my arrival at the agency, I appointed a Personnel Director with seventeen years of private sector experience to professionalize a unit which has lacked direction for many years. The Director has made substantial progress toward that goal and is presently working on the establishment of an agency-wide personnel evaluation system.

Contract Administration - One of my first initiatives as Metropolitan District Commissioner was to establish an internal task force to examine the contract administration process. This group has reviewed each step of the process from the selection of consultants to their follow-up evaluations. The recommendations of this task force will be submitted to my office by September 30th for my review.

In order to accomplish these and other goals, we must convince the public and the Legislature that what is lacking at the Metropolitan District Commission is a resource base and not a commitment to excellence. Your report, I believe, vividly demonstrates the former. Our job now is to convey the latter.

I look forward to working with you.

Sincerely,

William J. Geary
Commissioner

WJG:kc